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The Oram Time Indicator.

The object of this instrument is to give to every telephone subscriber an opportunity to know the exact standard time at any moment by simply taking down his receiver and holding it to his ear.

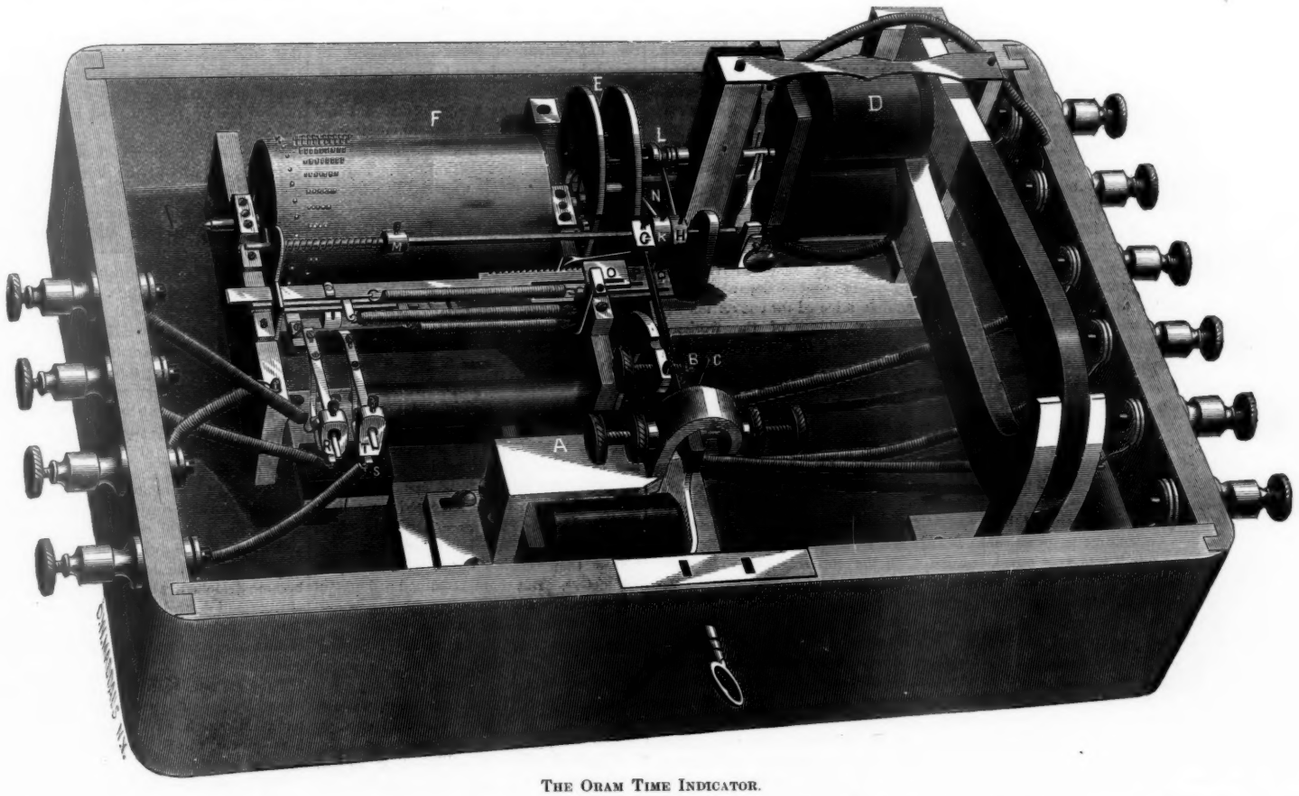
One instrument only will be required for each exchange, it being connected into all the circuits through the ground wire at the back of the switch-board. The cost to each subscriber has been fixed at one dollar per year—an amount so insignificant that few, if any, subscribers will care to dispense with it. It is owned by the National Time Indicator Company, of which Mr. H. P. Frost, general manager of the Southern New England Telephone Company, is president, and Mr. Loren N Downs, general manager of the New England and Erie companies, is treasurer. The directors are Theodore N. Vail, O. E. Madden, H. P. Frost, H. B. Lytle and Loren N. Downs.

The operation of the machine is as follows: During every minute of the day, and exactly on the minute, a special signal from a standard clock is sent over all the lines that are to receive the time. This signal is easily distinguished, and, on account of its peculiar sound, it is called the "buzz." By mechanism hereafter to be described, this machine strikes out the exact hour and minute at which each buzz occurs. Thus a subscriber, wishing to set his timepiece, has simply to take down his telephone and put it to his ear. Presently he hears, ticked out in a manner very similar to the fire alarm, two blows, and, after a short interval, he hears three blows, soon followed by five blows. This means that when the next buzz comes it will be exactly two o'clock and thirty-five minutes. A more detailed working of the machine may be seen by referring to the engraving. *A* is an open circuit relay, the coils of which are connected through a battery with a circuit-closing device on the arbor of the second wheel of a clock, which may be located at any distance from the machine. The points *B* and *C* form the local contacts of the relay. *C* is connected to the ground wire of the exchange, which has been connected from the earth. *B* is connected to ground through a battery of about one cell for every one hundred lines. The hammer *T* is connected to ground through the same battery that leads to *B*, and the contact point under the hammer is connected with point *C*. Thus closing the circuit through *B C*, or through *T*, will send a current through all the lines connected with *C*. The point *C* is on a light spring attached to the armature of the relay, so that, when brought up suddenly before the point *B*, there is for an instant a vibrating contact at exactly sixty seconds of every minute. The circuit through the relay is closed at the clock, thus connecting the points *B* and *C*, which send a vibrating signal through all the lines connected with *C*. This signal is readily recognized as the buzz.

The relay *A*, in addition to sending the special minute signal, controls the striking mechanism, which operates as follows: *D* is an electro-motor, which revolves continuously at a high speed, and at regular intervals is made to revolve the repeating cylinder *F*, through the diminishing train *E*. The cylinder *F* is provided with three sets of teeth, one set consisting of twelve rows to strike the hours. The next consists of five rows to strike the tens of minutes, and another set, composed of nine rows, to strike the minutes. In front of the cylinder are three toothed racks, capable of a sliding motion in a direction parallel to the axis of the repeating cylinder. Each rack corresponds to a set of teeth on the cylinder, and is provided with a lever, which, when acted upon by the teeth of the cylinder, trips the hammer *T*, and closes the circuit at *S*, which is normally held open by a spring on the under side of *T*. When the relay is actuated by the minute signal from the clock, the motor is made to engage the train *E* by means of the arms *G*, *H*, and the pulley *L*, which is provided with a clutch, and thus the cylinder is caused slowly to revolve. In its revolution the teeth on its surface trip the hammer *T* a number of times corresponding to the hour and minute of the day.

Each revolution of the cylinder causes a change in the position of the racks *O P Q*, in readiness to strike out the next minute. These racks are shifted by a spring cam (not shown in the cut) at the right of cylinder, which plays into the notches on their upper edge. The minute rack *Q* moves one notch a minute, and when it has reached the tenth minute it is withdrawn by a spring, and the cam moves the ten minute rack, which, in its turn, allows the cam to move the hour rack, which moves once an hour. When the cylinder has completed a revolution, the motor is automatically thrown off by means of the hooked arms *K* being forced by the spring *M* into a slot in a disk on the shaft of the cylinder, a part of which may be seen at *N*.

In the early experiments it was found that, if only a portion of the lines in an exchange were connected with the time transmitter on nearly all the other lines which ran near them or through the same cables, the time signals could be read by induction or leakage. Inasmuch as there is no successful way of overcoming induction or leakage, it would seem that this difficulty is insurmountable. This is not the case, however, and this trouble has been avoided in the following simple manner: All lines over which it is not desired to send time are connected to the confusing hammer *R*, so that, in addition to having time signals by induction, they will hear a series of faint, meaningless ticks interpolated between the time signals. This confusing signal, being of the same strength and character as the time signals, cannot be distinguished from it. It may be added that the



THE ORAM TIME INDICATOR.

use of this instrument does not in the least interfere with the clearness and distinctness of conversation over the lines. It is already in successful operation on the New Haven Exchange of the Southern New England Telephone Company, and is to be introduced on the other exchanges in their territory. Negotiations are in progress for its application to the exchanges of the New England and Erie companies, and applications for it have been received from all over the country.

The Electrical Transfer of Energy.

Researches of M. Marcel Deprez.

The starting point of these researches by M. Deprez may be referred to the Electric Exhibition of 1881. Doubtless M. Marcel Deprez had experimented before this date, but it was in his laboratory, on a limited scale. Several persons have, indeed, had the opportunity of seeing an instance of distribution effected in his laboratory, but it was at the Palace of Industry that he displayed his results for the first time to the public.

The installation which he erected there was an instance of the electric transfer and distribution of energy. As regards the transfer, it does not differ widely from what had been effected by others. The total length of the cable was about 1,800 meters. The power collected was not measured, but about four horse-power was expended. It may be said, further, that at that date there was no great interest felt in measuring, with precision, the power and the result, an affair which shortly afterwards became of such importance. To succeed in transferring power under any conditions seemed then an interesting result. From this point of view the installation of M. Marcel Deprez seemed about as good as any other. The feature in which it was unrivaled and altogether exceptional was, that not content with merely transmitting power, it distributed such power among numerous distinct machines, each acting independently of the others; in a word, it worked with distribution. This was the first realization of the principles which have been already expounded. The double cable conveying the current went entirly round the Palace of Industry, with derivations, both on the ground floor and on the first story, to 27 distinct apparatus, some detached, and others arranged as in a workshop, and comprising sewing machines, folding machines, machines for ribbon sawing, for wire weaving, arc and incandescent lamps, and, lastly, a printing press. Each apparatus had its small electro-motor, most of them a magneto-electric motor on the Marcel Deprez system; some, among others the press, had small Siemens dynamo machines.

This was certainly a mere experiment, but on a large scale, approaching to practical dimensions. At any rate it was very novel, and, as was generally remarked, it was at least a brilliant departure which promised well for the future.

In the International Congress of Electricians, in 1881, M. Deprez had explained his ideas and the general theory of the transfer of power such as he had conceived it; this theory, we may remember, has encountered much contradiction. The application, as it was said, was limited both as to the distance and the quantity of power. It was necessary to go further—to confirm the theory by precise experiments, and to carry out its application on a scale of industrial utility.

It is true that the author was not obliged to himself undertake these tasks. Many men of science, having announced an idea, stop, and do not consider themselves called upon to carry it personally into practice. This is doubtless allowable, and they have, after all, fulfilled their duties as savants and theorists. But if we cannot blame them, we should praise those who do not recoil from the arduous task of giving a material form to their ideas—an arduous task which demands, besides the attributes of the savant, others, lower perhaps, but not less rare, among which must rank first and foremost, a persistence which nothing can weary.

The first step on entering upon this experimental career was to verify, fundamentally and completely, the various bases upon which rests the theory proclaimed at the Congress, and explained, afterwards, before the Academy.

The details already given embody the most striking results of these experiments. As may be supposed, these are merely instances selected from a great many others. Especially as regards the characteristic curves, it was established by means of machines as numerous and as different as possible. Thus a very complete knowledge of the various types was acquired; the instruction collected was very precise for future improvements, and for preparing designs of machines which may be constructed hereafter.

In the meantime, everything was being prepared for experiments on transmission to a great distance. One of the first theoretic researches of M. Deprez consisted in showing that with existing types of machines we might, by the aid of a transformation mathematically calculable, succeed in effecting a transfer to a great distance. The calculations were based on experiments made by English engineers at Chatham with electric light machines. The data furnished by these experiments were very vague, as they had not been undertaken for the object aimed at by M. Deprez. The first experiments, however, carried out in the laboratory permitted them to be completed, and a transformation could be undertaken conformably to theory, and which must effect the purpose aimed at.

The utility of this experiment may be conceived. Of course, it cannot completely answer the conditions to be fulfilled, and can yield the result only with difficulties, in a troublesome manner, and liable to accidents. In order to succeed fully it was necessary to construct new machines. This fact was not overlooked, but this construction presupposed long studies. It was necessary to examine separately the influence of each part. Then, when the type was determined, time was still needful to effect any required correction. The use of these machines allowed of rapid experiments at a moderate cost, and had the immense advantage of placing the principle beyond doubt, of replying to objections, and of securing the future by establishing a firm point of departure.

The machines selected for conversion were two Gramme machines of the workshop model. They were fitted with new coils of finer wire, were modified in several of their parts, and were finally used in the experiments. On February 13th, 1882, M. Marcel Deprez was able to announce to the Academy that he had succeeded in transmitting 27 kilogrammeters against an artificial resistance of 786 ohms, representing a length of 78.6 kilometres of telegraph wire. The return was estimated approximately at 25 per cent.

It must not be believed that the affair proceeded with the convenient rapidity which this brief account might lead the reader to suppose. Many obstacles were encountered, but not those which had been announced. We are not speaking here of M. Deprez and his friends, who knew approximately what might be expected. But in the electrical world, it was said on all sides that this would never work. Each one had his reason. At the first trial the machines, it was said, were to melt, burn, and be destroyed by the heat. Not only did nothing of the kind occur, but no machines had ever been so cool. The most ordinary light machines heated incomparably more than these. The real difficulties encountered lay, as was known to those who had studied the question, in the novel use of high tensions. It was necessary to employ great care in insulation; to arrange commutators of new forms to prevent the origination of voltaic arcs, very difficult to extinguish at the moment of interrupting the current. It was even needful to employ especial methods for effecting the interruption, as any sudden break was seriously injurious. Thus, as we advanced, difficulties presented themselves, inherent in the use of electricity in this novel form, and successively they were overcome.

It was about the beginning of 1882 when the Technical Commission charged with organizing the Electric Exhibition at Munich placed itself in communication with M. Deprez. The question of transmission had been already raised at the Paris Exhibition, and it was decided to render it one of the main features of the Munich Exhibition. But, as may be understood, it was desired to present the transmission under novel forms and to show results which had hitherto not been seen. The commission addressed itself to various German firms, asking their assistance. Messrs. Siemens & Halske declined the proposal, doubtless being able to do merely what they had done previously and not wishing to repeat themselves. Messrs. Schuckert accepted, and effected a transfer to the distance of five kilometers. The motor machine was impelled by a fall of water on the river Isar, at Hirschau. The conducting wire was of copper, and presented a total resistance of 12.61 ohms.

It is necessary to insist upon this point. We must carefully note that in transfers the distance does not act strictly by its length but by the resistance of the conducting wire necessary to connect electrically the two machines. Doubtless, we may diminish this resistance by selecting a good conducting metal and increasing the diameter of the wire. But this can only be done by increasing the expense. Now, we must remember that the transmission of power is not merely a scientific question, but should admit of an industrial application. Hence, economic considerations play an important, and even a preponderating part. If the transfer is to have any interest, the distance must be considerable and it must be traversed by means of a cheap conductor, that is, a wire relatively slender and therefore having a considerable resistance. As will be seen directly, the experiment of Messrs. Schuckert responded very imperfectly to these conditions, the distance being small and the conductor very thick. Hence this transfer did not differ essentially from former experiments, and especially from what had been done at the Palace of Industry in 1881. For the rest, no measurements were made with this transfer, which is the more singular as the Munich Exhibition was got up for the very purpose of securing precise data, and the apparatus were generally submitted to a thorough examination.

We now come to the most important experiment.

M. Deprez having announced that he purposed working to great distances, the commission immediately proposed to him to go to 50 kilometers, and offered him as conductor, an ordinary telegraph line. Here were certainly conditions quite exceptional, nothing of a similar kind having yet been attempted. As to the resistance to be overcome, M. Deprez was prepared; we have described one of his experiments in which he traversed in his laboratory resistance greater than the 500 ohms. of a line of 50 kilometers. But there remained a doubtful point—to know how a telegraph line would behave, if its insulation was sufficient, if atmospheric disturbances had any influence. Experience alone could answer. To accept the investigation thus publicly, at so great a distance and under such conditions, was certainly bold. M. Deprez was bold enough, and he was justified by success

It must be added that at this time he had no dynamos furnishing high tensions save the two transformed Gramme machines which have been previously mentioned. These apparatus were originally imperfect, and were already a little injured by the experiments for which they had served. These he sent on to Munich. The first project was to effect the transmission between Augsburg and Munich, but a Bavarian manufacturer, M. Fohr, who had works at Miesbach, a small town at a distance of 57 kilometers from Munich, urged that the generating machine should be placed there, and undertook to supply the necessary power. The distance was about the same.

As a conductor, the existing telegraph line was employed without alternations. It was at first intended to effect the return by the earth, but on further reflection this idea was abandoned and a second telegraphic wire completed the circuit. This arrangement certainly doubled the resistance of the line and, consequently, the difficulty of transport, but it was thought necessary to avoid danger. The effect of high electric tensions was then excessively dreaded; and if the earth was used for a return, the body of any person touching any point of the line would form at once a derived circuit.

It was subsequently found that high tensions were less formidable than had been supposed. Still, it is certainly imprudent to play with them, and a return wire seems a necessary precaution. It seemed still more important at the time in question. Thus arranged, the line offered a total resistance of 950 ohms according to the measurement of the commission.

On the day when M. Sarcia, the engineer employed by M. Deprez, announced that he would make his trial, many members of the commission were present, and when, on the signal being given, the obedient machines began to move, there was a burst of applause. The machine at Munich was employed to work a rotatory pump, feeding an ornamental cascade.

The success was clearly and fully proved, but, as might have been expected, a number of small accidents interfered to limit its duration. On this subject it is best to quote the certificate given by the Commission:

"The dynamo machines were set in motion for the first time on September 25th, at 7 P. M., and, according to the data of M. Datterer, the engineer appointed by the committee, the receiver placed at Munich revolved at the speed of 1,500 turns per minute, the brake, serving to measure the work, being loaded with 1.5 kilog.

"A series of accidents, due to the fact that the machines were constructed for laboratory experiments and not for practical work, arrested, after eight days, the progress which up to that time had been completely satisfactory. The circles surrounding the ring of one of them broke, consequently the wire of the ring of 0.4 mm. in diameter were damaged, and had to be insulated afresh. In the remote town of Miesbach these repairs were effected with great difficulty, and required, on the part of the assistants of M. Marcel Deprez, much patience and perseverance.

"On October 9th and 10th, when the Commission of Investigation commenced its measurements, the greatest speed attained at Miesbach with the repaired machine was 1,600 revolutions per minute; the results were consequently much less favorable than they had been with the normal velocity of 2,000 revolutions per minute obtained at first.

"During a few moments only it was found possible to reach, during the measurements, the speed of 2,000 revolutions per minute, and quite at the beginning of the experiments one of the brushes of the machine became detached, which produced an extra current and destroyed the machine."

It will be seen from these extracts that the results were obtained under disadvantageous conditions.

They are not, moreover, perfectly exact, especially from the transmission dynamometer at Miesbach having been made for 15 horse-power, was ill adapted for the measurement of small forces.

The results were the following: work received 0.15 horse-power, electric return 38.9 per cent. The mechanical return was not measured, but it is estimated at about 30 per cent.

All this, doubtless, was but a beginning; but it differed so widely from the attempts previously made, that a great outcry was raised. There was a brisk, indeed a violent, discussion on the results, the procedures, and everything which seemed open to attack. However, as was said by M. Cornu in a report to the institute, to which we shall have to return below: "The very violence of the polemic which has arisen on this question suffices alone to show that the author, if he has not solved the problem, has at least approached it very closely."

It was impossible to stop on so open a road. Along with these public trials, laboratory

experiments were also advancing, and M. Deprez succeeded in deciding on the construction of his permanent machines.—*From La Lumiere Electrique.*

The Electric Light on Shipboard.

The application of electricity to the lighting of ocean steamships has advanced during the four years following its introduction with a rapidity which must have astonished even its most sanguine promoters.

To Mr. Swan and to Messrs. Siemens Brothers & Company this success, which has attended the combination of their systems, must be highly gratifying, but such considerations are far outweighed by the immense advantages which have accrued to the practice of electric lighting by the steady development of a complete system, and the step by-step elimination of the various defects in the apparatus or arrangements, which at one time caused the electric light to be considered fitfull and uncertain.

The conditions under which electric light is produced at sea differ considerably from those which are found on land, principally owing to the very limited space available for the machinery and to the inevitable motion of the ship. The space available for the engines and dynamos in the largest vessels is usually about 24 ft. by 9 ft., which has to accommodate duplicate machinery for maintaining about 500 incande-cent lamps. Even this small space is often marred by the presence of a mast or a huge steam pipe. In the earlier examples of electric lighting on shipboard the machines were driven, as on land, by a plain horizontal engine and long leather belt, the axes of the machine being placed parallel with the keel. This method of driving was practicable where the total amount of power to be transmitted was small and the space large in proportion to the size of the engine and machine; but it is evident that in the larger installations which are common at the present time, this method of driving would be very inconvenient.

The practice of the Swan Company and of the Edison Company has been, until very lately, to drive their machines by one or the other of the well-known high-speed engines of Parsons, Brotherhood, Heenan & Froude, or Westinghouse, the shaft of the engine being coupled direct to the spindle of the machine; on the other hand, Messrs. Siemens Brothers have preferred to use ordinary slow-running engines geared to the machines by Raworth's well-known rope gear or friction gear. The space occupied by either of these arrangements is not necessarily larger than with high-speed engines, and it is claimed for these systems that they are simpler, cheaper in the first cost, and more economical in working. The remarakble immunity from breakdowns which has characterized the Siemens installations, probably accounts for the fact that in the later installations of the Swan Company, and the Edison and Swan United Company, rope driving has been adopted, as for instance in the s. s. Valletta (P. and O.) and the s. s. Adriatic (White Star).

One great advantage of rope driving is that the machine may be placed very close to the engine; for instance, on the s. s. Arizona, there are two S D_{00} machines capable of supporting 300 lamps; each machine is driven by a horizontal engine with a cylinder 9½ in. by 14 in., and although the indicated horse-power transmitted cannot be less than 38, the clear distances between the peripheries of the fly-wheel and machine pulleys is only 3 ft. These machines have been working eighteen months, and no trouble has been experienced with heated bearings.

As the result of Messrs. Siemens' experience and practice, we note the following points as essential elements in the system which has led to success at sea, and which may produce equally satisfactory results on land.

1. *Motive Power.*—A strong plain engine, with very large wearing surfaces, especially on the crank-pin; a crosshead with perfect arrangements for continuous lubrications of the moving parts; and a highly sensitive governor controlling a throttle valve, the expansion valve, if any, being regulated by hand.

2 *Transmission.*—Rope gear with ample provision for tightening the rope whi'st running, or friction gear with a large margin of safety and complete arrangements for lubrication. These systems are quite free from the slight pulsations in the strength of the lights which are often visible with strap driving, owing either to thick or thin places in the belt, or to waving and flapping of the belt where the centers are far apart.

3 *Safety.*—Duplicate machines, each driven by a separate engine, with hand adjustment to the governor, so that the speed and consequent electro-motive force may be adjusted accurately by the test lamps or voltmeter before changing from one machine to the other.

4. *Circuits.*—Complete arrangements on the keyboard for changing to or from any circuit or machine whilst running without stopping or sparking, also for coupling machines parallel prior to changing from one to the other, so that the act of changing may not affect the strength of the light. To carry this out successfully the keyboard should be close to the engines, and every key should be properly labeled to avoid mistakes.

With machinery arranged on this system a steady light may be maintained for any length of time without fear of failure, even on vessels without duplicate machines. On the City of Rome and Alaska the engine-room and some other lamps are maintained without stoppage from Liverpool to New York, and *vice versa*. The system of using the hull of the ship as "return," which is now known as "the single wire system," originated with Messrs. Siemens Brothers & Company, and possesses the following advantages:

1. With a given sectional area of conductor the resistance is one-half, and the cost one-half, as compared with the double wire system; or if the same weight of copper be used, the resistance of the single wire system is only one-fourth of that of the double wire.

2. The cost of laying the wires is very small.

3. The extreme simplicity of the fittings and attachments makes it easy to guard against short circuits in the keys and lamp-holders.

4. The average distance of the conductor from the metal of the ship is very much greater than the distance between double conductors under ordinary circumstances.

The next point worthy of notice in the Siemens' system is the large number of branch or sub-circuits. No lamps are coupled direct to a main conductor, but branch wires are taken from the main, each forming a section of ten or twelve lamps. At every junction with the main conductor there is a safety bridge and key, and a descriptive name-plate. This arrangement reduces the effect of an accident to the smallest proportion, and makes it a simple matter to trace and rectify faults. By a judicious selection of two or three places from which to start branches, the main conductor may be kept almost free from joints, and we are informed that in consequence of a strict adherence to this principle, there has not up to the present time been a single instance of trouble with a main conductor. This possibly is due, to some extent, to the use of a wire specially insulated, and served with jute for use on ships, or, in other words, to the fact that the single wire has got the insulating material of two ordinary wires and the jute in addition.

The section safety bridges mentioned above are not arranged to protect the lamps as commonly supposed, but are made thick enough to stand a current much stronger than the normal, but they will melt with less current than is necessary to damage the smallest single-light wire in the section. The section keys break the circuit at two points to prevent arcs forming, and they make a very tight and clean contact.—*Engineering.*

Clinton R. Weeden, Esq., of Providence, R. I., was elected President of the Time Telegraph Company of New York, on Monday last, vice Calvin Goddard, resigned.

A Suggestion as to Overhead Wires.

What shall be done with the wires which, like threads of a huge web, hold the New York streets in a mesh-like tangle, is a question as perplexing as it is important.

The Board of Alderman say that such of them as pertain to electric lighting plants must be buried after May, 1885; one branch of the Legislature says that both electric light and telephone wires must be underground by June 1, 1885, in cities of 50,000 inhabitants or over. Lastly, the sub-committee appointed by the representatives of the electrical companies, exclusive of Western Union, after considering the subject for several months, have decided that wires of all descriptions should go underground, and suggest that the municipality provide suitable subways for their reception. Singularly enough, neither the Legislative investigating committee nor yet that appointed to represent private interests, considered what would seem to be by far the most important point bearing upon the subject in hand, viz., the convenience of the general public.

No reasonable person will deny that electric mains carrying powerful and dangerous currents should be placed out of reach. But telegraphic and telephonic wires are dangerous neither to life nor property, and so far as they are concerned, the question would seem to be: Is their unsightliness and the annoyance attendant upon their repair of more importance to the general public than the additional expense of their use, which it is but reasonable to look for when the costly subways and tunnels shall have been built?

If the telegraph and telephone were only for the rich—that is, for the few—it would be neither surprising nor illogical if the many should object to the invasion of the streets and the roofs of their houses. But such is not the case. Both services have become generally popular, and already so much used as to have become almost a necessity.

So far as the telegraph is concerned, the public is looking forward to a very decided reduction in the rates, and, considering the conditions under which the service is performed to day, there seems to be no reason why they should not be gratified. But if no one is willing to be the least inconvenienced for the sake of the general welfare, if no one is willing to have a wire pass his door or cross his roof, he may not reasonably expect at the same time to have a cheap service.

It is much the same with the telephone. Increase the expenses of the companies, and you force them to increase their rates for service. This tends, as a natural consequence, toward limiting its usefulness, for no matter how convenient it may be in the transaction of the ordinary affairs of life, it cannot, if it be expensive, be popular.

If a man objects to the clatter of the milk wagon and the baker's wagon before his door, he can, if he does not mind the additional expense, have his milk and bread brought to him by hand. But it would be manifestly unfair and unreasonable to expect that his less fortunate neighbors should incur a like expense that he might not be disturbed. Equally absurd would it be should he expect his milkman and baker to go to the additional trouble of serving him by special messenger at the same rates, and still worse, to even demand a reduction in these. The fact is, every one should be willing to sacrifice something for the general welfare. With this view, it would seem as though a plan might be devised by which the telegraph and telephone wires could be systematically led over the roofs of the houses, without proving a special hardship or annoyance to any one; and we must confess it seems somewhat surprising that no such plan has, so far as we know, been considered. There is good reason to believe that, with proper supervision by constituted authorities, the general and indiscriminate scrambling over roofs now indulged in by linemen could be avoided in great measure. The unsightly street poles could be done away with, and the wires now strung on them be laid in the same order over roofs of the houses. When damage of any kind resulted, such as injury to a chimney or roof, those who had general supervision over all the wires could readily decide who was responsible for it, and hence who must repair the injury done.

Nor is it by any means certain that the construction of subways through the main thoroughfare would, though increasing the cost of service, abate the alleged nuisance of stringing the wires over the houses. Telephones and burglar alarms are usually run over the tops of the houses and across the yards and courts, and unless all the side streets, as well as the avenues, were undermined, and so unnecessary and costly an undertaking has not, we believe, even been contemplated, there would be little or no diminution in the number of wires crossing the roofs.

In the plan we have suggested, the telephone and telegraph wires could readily be kept apart, as, indeed, could the lines of the various companies.

What most commends this plan is its cheapness and convenience, which characteristics, if we mistake not, are the essentials to every scheme in which the general public is looked for to take part.

The public demands cheap telegraph and telephone service, and that this may be had by any of the recent plans to sink the wires we must, in candor, confess there are grave doubts.—*Scientific American.*

Lighting the Criterion Theater.

Chief among the many improvements introduced by Messrs. Spiers & Pond, at the above-named theater, says the London *Electrical Review*, is the illumination of the entire house by the electric light. The work was intrusted to the Edison company, about the middle of last year, and was carried on by them until the amalgamation with the Swan company. The joint company has completed what is perhaps the most perfect example of theatre-lighting in London. The total number of lights in use is over six hundred.

In the auditorium and stage there are about 510 lights, and these are divided into ten separate circuits, each of which can be raised or lowered by means of German-silver wire resistances introduced into the circuits, each of which is subdivided into fifteen gradations, and all can be controlled singly, or as one common circuit, and either circuit can be extinguished without perceptibly affecting the remaining lights. The lamps used are all of the Edison pattern, ranging from ten to fifty-candle power. The general effect produced by the light is as good as can possibly be desired, and we need hardly dilate on the pleasant change in the temperature and freshness of the air of the house, so often noticed by visitors to the Savoy Theater, which is, we believe, the only other theater in London completely lighted by the electric light. The temperature of the air in the house never rose above 60°. The steam power is obtained from boilers put in for other purposes, such as heating, etc. The engines are two in number, of the Armington & Sims high-speed type, each capable of doing the whole of the work at their normal speed of about 240 revolutions per minute. Each engine is connected, by means of leather belting and friction clutches, to a counter-shaft, on which are placed four smaller friction clutches, which are in turn connected by belts to four Edison L machines, the normal output of each machine being 150 lamps. But, should occasion arise, it could for a limited time be increased to about 200, so that if one machine failed it could be instantly disconnected, and the remaining three would then drive 600, practically all the lights absolutely necessary. We are told, however, that Messrs. Spiers and Pond are intending to add two larger dynamos of the same type, so as to have more spare machine power, and to enable them to light up their new grill-room, which would be an inestimable boon to all West End wayfarers. The work has been most carefully carried out by Mr. T. O. Belshaw, assistant engineer of the Edison-Swan Company. Since starting the permanent running of the light on the 15th instant, there has been no hitch of any description, and the success of the undertaking appears to be beyond all doubt.

Electrical Review.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, MAY 24, 1884.

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AN IMPORTANT PURCHASE.

The publishers of the ELECTRICAL REVIEW have purchased the good-will, copyright and subscription lists of the *Electric Light*, a paper devoted to electrical interests, which has been published in Boston during the past six months. The *Electric Light* now ceases to exist as a distinct publication, being merged into the ELECTRICAL REVIEW. All unexpired paid subscriptions to the *Electric Light* will be filled by sending the ELECTRICAL REVIEW for the unexpired term of such subscriptions without further charge to the subscribers.

This purchase makes a material addition to our subscription list, and makes a decided and most desirable increase in the circulation of the ELECTRICAL REVIEW—a fact as important to our advertisers as it is gratifying to ourselves.

Mr. Robert Hammond has written an article for the *Tall Mall Gazette* in which he maintains that electric lighting is destined to grow into an industry of vast proportions, and that those interested in it will reap an abundant harvest if they will but be patient.

People who oppose the use of the electric light, "point with pride" to the fact that Paris, which went into electric lighting with a rush at the start, very largely discarded it at the end of a couple of years. But they are just now keeping very quiet about the fact that the electric light is in process of re-introduction into the gay capital, and that the municipal council has come to the conclusion that the city cannot afford to rely on gas.

"Moths are caught by glare," and now it is proposed to try the same mode of allurement on fish. An incandescent light is put into the net, and kept at its brightest. The fish gather from far and near to see the sight, whereupon the net is hauled in, and the fish pay for their curiosity with their lives.

Our British namesake is doing what it can to point out to the English public the advantages of automatic fire alarms worked by the combination of a thermostat and an electric current. Such devices, of which there are a number of varieties, are in very general use in this country, but it will probably be a long time before our English cousins bring them into practical use. John Bull loves to deliberate and to wait.

The following from the Boston *Transcript* seems to point straight at electricity: "The most important problems in housekeeping are lighting and heating, and when solved in a practical way, the gas company and the coal yard may be dispensed with, and to this end the inventive genius of the hour is directed. Hundreds of inventions have already been made and many most significant successes have been obtained. The telegraph and the telephone are not the end of ingenuity and invention in this age."

We were privileged to have a talk over the copper circuit between Boston and New York this week. Conversation was fully as easy and distinct as when carried on between two stations one hundred feet apart. Since the line was established experiments have been in progress looking to its connection with the general service in the two cities, and the difficulties presented have been pretty much all overcome. It is reasonable to expect to see the line open for commercial use before very long, and it may also be reasonably inferred that other leading cities will, before many months, be connected in the same way.

Competition in business is a good and excellent thing, but when it calls to its aid falsification and abuse, it ceases to be honorable, and becomes unworthy of business men who wish to maintain a reputation for fair dealing. We regret to say that a case has recently arisen in the western part of this State in which two electric lighting companies sought, through their agents, to obtain the same contract, where one of the agents, forgetting that the good name of his company was at stake, resorted to absolute falsification to gain his point. He has retracted his statements over his own signature, and confessed his misdeeds; but is that enough? Should not the company which employs him, and in whose name he acted, disavow his acts? "Never more be officer of mine," should be its attitude.

As it is to become the duty of the city authorities of New York and Brooklyn to take down all wires which remain overhead November 1st, 1885, and as the job is likely to be a big one, it is suggested that they begin now with their own wires, viz.: those belonging to the fire alarm system. Under the law, as we understand it, they have got to come down and run underground, and it would be just as cheap for the city to do it now as any time. Then again, the practice and experience, the City Fathers would get in this little job would be invaluable to them when they come to take hold of the big one. By all means let us have the fire alarm wires down and out of the way of danger from sleet storms before next winter sets in.

Elgin, Ill., believes, and is prepared to prove to anybody that will take the pains to go there, that thirty arc lights of the usual power, scattered over an area of two miles square on seven towers one hundred and fifty feet high, will give more effective illumination than one hundred similar arc lights placed on poles of the height generally used in our streets. The towers are so arranged that each is depended upon to light a circle at whose center it stands, and whose radius is two thousand feet. The tower system has been very extensively and successfully used in the West, and it is singular that it has found so few advocates in the East. It would hardly answer for compactly built cities, but there are many cities and towns in the Eastern and Middle States where it might be used to as good advantage as in Elgin.

And now they are seeking to lay Vandal hands on the fair fame of Franklin by suggesting that he "was probably anticipated in his discovery of lightning conduction," on the ground that the ancient Etruscans understood the art of guiding the lightning, and because it is claimed that in ancient times the priests ignited their fires by lightning. We may be induced to believe that Washington never owned a hatchet, and that his father never had a cherry tree; but wild horses would be unavailing to drive from our mind the conviction that Franklin stood behind the barn in a thunder shower and drew down the lightning by means of a kite, a string and a door key for the first time in the world's history. Let us hold to *something*.

In an extended article concerning the Philadelphia Electrical Exhibition, *Engineering* says: "It is running no risk to prophesy that the Exhibition will be a success in a land where the names of Bell, Edison, Brush, Maxim, and a crowd of other electricians are household words, and where their productions are to be found at every turn." The article closes as follows: "There can be little doubt that many inventors on this side of the Atlantic will avail themselves of this opportunity of bringing themselves before the American public. There the average capitalist is not endued with the suspicion and timidity which prevails in older countries, and a really good and useful article finds a ready sale on its merits, and does not need the excessive pushing which is necessary here, except at remote intervals, when the investing public has a temporary fit of enthusiasm."

It is sad to see an interest which claims a monopoly of the good, the beautiful, and the true, and which holds up its hands in horror at the temerity of any one who contradicts that it is altogether lovely, torn into contending factions and washing its soiled linen in public. Here is the gas interest, which presents a bold and unbroken front when it meets the competition of electricity, engaged in a factional fight before the General Court of Massachusetts, where the water-gas people are trying to get a footing. Their bill passed the House, and was in a fair way to pass the Senate, but two Senators who were pledged to its support experienced a change of heart over night, and the bill failed in the upper branch. Of course the water-gas people charge corruption, and have procured the appointment of a committee to investigate the matter. The established gas company's reply is "you're another," and altogether things are very lively indeed, and form an interesting and instructive spectacle. It is at least demonstrated that the methods which the gas companies adopt to keep their footing are, like the kangaroo Josh Billings had, "pecooliar."

We are very glad to see that in the circular issued by Professor R. H. Thurston, chairman of the Section of Mechanical Science of the American Association for the Advancement of Science, it is distinctly stated that "papers and exhibits void of scientific interest are not desired, and everything of an advertising character will be rejected." This Section of Mechanical Science, known as Section D, is of comparatively recent establishment. It is especially devoted to the advancement of all the sciences most directly applicable in the arts, and in the departments of engineering, civil and military, mining, mechanical and electrical, and in architecture. It thus covers a very important and interesting field of research, and it is hoped that the circular of invitation just issued will result in bringing before it a number of important and valuable papers. But once let it come to be looked upon as a medium for the grinding of individual axes, and its value would be gone.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

As reported in our issue of last week, the American Institute of Electrical Engineers has been organized, and a list of officers for the first year, whose names we have already published, has been chosen. A set of rules has been adopted, which are the outcome of the labors of a committee previously appointed for the purpose, and of such changes and amendments as grew out of the consideration of their report at the meeting last week. It seems unnecessary to give these in full, but it may be well to give in brief some of their more salient features for the information of our readers.

Members are divided into two classes. Full members—or, as they are technically called, "members"—are those who may justly be called electricians, because of professional employment and general recognition as such. All others are to be associate members—persons who are connected with electrical matters, directly or indirectly, but do not rank as electricians. Thus the president of an electrical company might or might not be entitled to full membership, but there would be no question as to the standing of a professional electrician employed by such a company to do expert work.

In order to avoid complication and misunderstanding, this matter of classification of those belonging to the organization is left to the Council, which is the governing body of the institute. It consists of the president, the six vice-presidents, the twelve managers, and the secretary and treasurer. The president serves for one year; of the vice-presidents, two go out of office each year and are replaced by others chosen for three years; and of the managers, four go out of office each year, being succeeded by four others chosen for three years. The secretary and treasurer are chosen annually. There is no distinction between members and associates in the matter of voting or office-holding privileges, or in the matter of dues. These are five dollars entrance fee for each, and ten dollars annually in advance. Every person desirous of joining the institute must be proposed by at least three members or associates. His name then comes before the Council, which will pass upon him, and, if satisfactory, will determine to which class he is entitled to belong. It will then submit his name to the members and associates, who will, by letter-ballot mailed to the Council, determine the question of his admission.

Such, in brief outline, is the scheme of organization adopted. It has the advantage of being simple, easily understood, and easily administered; and, should weak points be developed by experience, it is easy to remedy the difficulty by amendment.

AMATEUR ELECTRICIANS.

It is something too much the habit to turn up their noses at amateur workers in the electrical field, and to look upon them as a necessary evil to be endured, rather than as a factor in promoting the development of electrical science. In all the arts the amateur has his place and plays his part, and in many instances his part has proved a most important one. Photography owes its development during recent years almost wholly to amateurs, who have freely given to the world, for the bare honor of the thing, the results of their experiments, often conducted at great expenditure of time and money. They went into it, not to make money, but in order to have something to be interested in, and, fearful lest some brother amateur should get the start of them, they made it a point to communicate their discoveries to the photographic journals at the earliest moment possible. It is to amateurs that the world owes the dry-plate process as at present used—a process which has brought photography within the reach of everybody, and made it available for many useful and most important purposes, especially as an adjunct of scien-

tific investigation, for which it never could be used before.

There are those who well remember that those who make a profession of the electrotyping of art subjects are indebted to amateurs for many valuable suggestions as to practical methods; and it is, no doubt, a fact that many other arts dependent upon electricity are indebted more or less to amateur investigation and experience.

England is the natural home of the amateur, but he is by no means rare in America, and he is yearly becoming less so. The "leisure class"—men who live upon assured incomes, and have no special employment—is increasing. It gets a set-back now and again when times are hard and dividends are cut down, but, as a whole, it is a growing class. While it, no doubt, includes many who are satisfied to devote themselves to nothing but the pursuit of pleasure, pure and simple, it also includes many who have a higher ambition, who find their pleasure in the study and practice of some art or trade as amateurs. The best bookbinding done in England is amateur work. No professional pretends to turn out photographs equal to some that amateurs produce, although, on the average, the professionals, of course, stand ahead, for the very simple reason that there are many amateurs whose knowledge is very limited. England is by no means without amateur electricians—men of leisure and of means, who study faithfully, experiment patiently and exhaustively, and stand very high in all matters pertaining to electrical research. Such men are not merely an ornament to society. They are an important adjunct to the art to which they devote their time and energy, and it ill becomes a professional to hold them in anything but the highest respect. In this country electricity is beginning to attract the attention of amateurs, and it is to be hoped that they will be encouraged to take hold of a subject which opens so wide and fruitful a field for research, and is certainly big enough for all, professionals and amateurs.

PATENT OFFICE LIMITATIONS.

At the meeting of the Institute of Electrical Engineers held last week, a letter was presented from Mr. C. J. Kintner, Examiner of the class of Electricity in the Patent Office at Washington, calling attention to the bill introduced into the Senate by Senator Platt, providing for a Patent Office Department entirely distinct from overruling authority other than the Commissioner of Patents. He adds: "It is a burning shame upon our national reputation that Congress should have permitted inventors to pay into the United States Treasury $2,500,000 over and above the expense incurred in examining and issuing patents, but such is the fact. During the past year this Bureau deposited to its credit over $571,000 more than was expended in the granting of patents for the current year. Is not this taxation without representation, and are inventors to sit idly by and submit to this while the Patent Bureau is crowded out of its building by other branches of the Interior Department?" Further on in his letter, referring to the inadequate force at his command for the proper examination of electrical patents, Mr. Kintner says: "I am now six hundred cases behind hand, so that were you to file an application to-day it would be four months before I should reach it. It is simply absurd that the Congress of this great country does not have the foresight to realize that by thus hampering this Bureau they are throttling the onward progress of an advanced civilization and unjustly robbing the inventor of funds which the founders of the Constitution never intended should be so diverted. Every dollar taken from the inventor by this direct taxation should be invested as was intended, so as to give him such an examination as the law calls for, and to insure an expeditious examination of his application."

The building in Washington which, by courtesy, is called the Patent Office, is in reality the Department of the Interior, of which the Patent Bureau forms but a part. As a matter of fact this Bureau is crowded into small and wholly inadequate quarters; its corps of examiners, and their assistants, who must, if their work is to be properly done, be men of ability and special knowledge, is by far too small, and it suffers from the fact that it is made subordinate to the Secretary of the Interior, who has it in his power to discriminate against a strictly business deportment in favor of some other into which the political element and "influence" more largely enter. It is eminently desirable, and indeed necessary, that the Patent Office should be put upon an independent basis, that it should at least benefit by the exclusive use of all the funds paid into the Government's hands as patent fees; that its force should be sufficiently increased to keep it abreast of its work so as to subject applicants for patents to the least possible delay, and that it should be in a position to pay its examiners and other experts salaries that will attract the best talent, and hold it. It is probably too late to expect to accomplish much this year, with Congress so near the end of its session and a Presidential campaign pending; but next winter it is perfectly possible for inventors to make themselves felt if they will but combine. With a very little organization Congressmen could be made to feel that inventors have some rights which it would be very wise for them to respect, and it would be very easy to make life very tiresome to the Senator or Representative who refused to lend a hand in bringing about a reform of present abuses.

RESULTS OF THE ELECTRICAL CONGRESS.

At the close of the Electrical Congress in Paris the delegates waited in a body on M. Grevy, President of the Republic, and addressed him through one of their number, M. Broch, the eminent representative of Sweden and Norway. His address fully yet concisely epitomizes the work of the Congress. After the usual complimentary introduction, he said: "We are happy to be able to announce to you that in this second session of our convention we have been enabled to arrive at definite results from our previous labors, and that our discussions have resulted this time in precise resolutions determining exactly two new practical units of electric resistance and of light. We have every reason to believe that, through the concurrent approbation of our respective governments, the definitions of the Congress will acquire the force of international law. We fully believe that the basis thus reached will be fruitful in results, beneficial to the many branches of human activity and industry, which are daily making more frequent and more general use of electrical energy; and that it contribute largely to the more rapid development of electrical industry and of international commerce. Congratulating ourselves upon this marked progress, we cannot help thinking that it is largely due to the initiative taken by France. Having founded the metric system, whose use is becoming so general that it promises to be the universal standard of the civilized world; after having instituted the adoption of measures which insure, by international methods, the preservation of this system in its integrity, it is again France which convenes us in this Congress, which results in the establishment of two new units, which will contribute to the honor of science and the welfare of mankind."

ELECTRICITY AT THE CINCINNATI EXPOSITION.

Of all the annual expositions in this country, none have been more successful or more productive of good than those which have been held in Cincinnati. The scheme was planned at the outset by liberal-minded, active business men, who meant that the expositions should redound to the credit of Cincinnati, and to her material advantage and prosperity as a manufacturing center, and their intentions and hopes have been more than realized.

Recognizing the growing importance of electrical arts, they have this year, under Class 72, as set forth in this catalogue, offered liberal awards for excellence in the different departments of electrical inventions and manufacture, as given below. The figures in the left-hand column refer to the number of the premium in each case, and are here given for convenient reference to the prospectus recently issued by Exposition managers. Electrical matters, as classified, come under Department F, Class 72:

INDUSTRIAL APPLICATIONS OF ELECTRICITY, TELEGRAPHIC AND TELEPHONIC APPARATUS, ELECTRIC MOTORS, ELECTRIC LIGHTING AND SIGNALING APPARATUS, DYNAMO-ELECTRIC MACHINES, ELECTRO-PLATING APPARATUS, ETC.

1528	Best System and Apparatus for Arc Electric Lighting.....	Gold Medal
1529	" System and Apparatus for Incandescent Electric Lighting.....	Gold Medal
1530	" Arc Dynamo-Electric Machine.....	Silver Medal
1531	" Incandescent Dynamo-Electric Machine.....	Silver Medal
1532	" Method of Insulating Electric Light Wires.....	Silver Medal
1533	" Display of Telegraph Instruments and Supplies.....	Silver Medal
1534	" Telegraph Set Key, Sounder and Relay.....	Silver Medal
1535	" Box Relay, Key Attached..	Silver Medal
1536	" Switch for from Four to Twenty Wires.....	Silver Medal
1537	" Pole Changer for Reversing Line Currents.....	Silver Medal
1538	" Insulator for Telegraph Lines.....	Silver Medal
1539	" Amateur Telegraphic Instruments.....	Bronze Medal
1540	" System of Automatic Telegraphy, in operation.....	Silver Medal
1541	" Instruments for Quotations	Silver Medal
1542	" Printing Instrument for Private Line.....	Silver Medal
1543	" Dial Instrument for Private Line.....	Bronze Medal
1544	" System for Telephone, in operation.....	Silver Medal
1545	" Telephone Transmitter....	Silver Medal
1546	" Electro-Telephone Call Bell	Silver Medal
1547	" Magneto-Telephone "	Silver Medal
1548	" Telephone Exchange Switch Board.....	Silver Medal
1549	" System for Electric Railway Signals.....	Silver Medal
1550	" Electric Train Signals for Railway Crossings, model in operation.....	Gold Medal
1551	" System of Fire-Alarm Telegraph, in operation.....	Silver Medal
1552	" Fire-Alarm Signal Box.....	Silver Medal
1553	" Automatic Electric Fire Indicator for buildings.....	Silver Medal
1554	" Electric Watchman's Clock	Silver Medal
1555	" Electric Hotel Annunciator	Silver Medal
1556	" Electric Gas-Lighting Apparatus.....	Silver Medal
1557	" Electric Burglar Alarm....	Silver Medal
1558	" Electric Clock.....	Silver Medal
1559	" Electric Engine for Motive Power, not less than one-Horse Power, in operation	Gold Medal
1560	" Electric Motor for Domestic Purposes.....	Silver Medal
1561	" Dynamo-Electro-Plating Machine.....	Silver Medal
1562	" Display of Electrical Test Instruments.....	Silver Medal
1563	" Electric Turnstile Register.	Silver Medal
1564	" Electric Railway.....	Gold Medat
1565	" Storage Battery, in operation.....	Gold Medal

It will be seen that liberal provision has been made for the recognition of merit in all departments of electrical industry, and manufacturers and others, even though they may exhibit at the Franklin Institute Exposition, in Philadelphia, which will be by all odds the most important electrical event of the year, will find it to their advantage also to show their wares in the Cincinnati Exposition, which is always important and always largely attended.

The admirably concise and explicit report of the Directors of the Southern New England Telephone Company submitted to the stockholders of the company on the 13th inst., will be found in full on another page. It shows that the affairs of the company have been prudently and carefully managed, and contain a suggestion to which we beg to invite the attention of other telephone companies. It is that "a reserve should be withheld every quarter for the purpose of meeting possible contingencies," such as the damage to plant from storms or other causes. This is the safe and conservative course, for, even though there be no storms, the time is coming when a very general reconstruction, at least partial, will be necessary to make up for wear and tear, and it is wise to provide for it in advance, even at the expense of a slight reduction in dividends. Attention is also called to the low rate at which many subscribers have their telephones, a matter which is agitating the minds of the directors of many companies just now. An average addition of a dollar a month all round would solve the difficulty.

The Block System in Arc Lighting.

Editors Electrical Review:—I was greatly interested in your article under the above head last week, and can easily see that, provided enough customers can be had in a given locality, the problem of overhead wires, so far as arc-lighting is concerned, would be solved. But it occurs to me to ask what, in such cases, would become of the large and in many cases expensive stations which companies have established in many cities. It would hardly pay to sacrifice them. STOCKHOLDER.

[The time to which we look forward is one when ten arc lights will be used where one is in use now, when companies will have many stations in the manner suggested, and when the demand in the immediate vicinity of present stations will be sufficient to require the use of a very considerable part of the machinery with which they are supplied. Any surplus could easily be removed to the other stations.]

Permanent Magnets.

To the Editors of the Electrical Review:

I wish to have made a number of permanent magnets of peculiar form. How should I go to work to get them as cheaply as possible? AMATEUR.

[Get Jessop's steel of the right dimensions and have a blacksmith shape them to the form desired. A file maker is the best man to have harden them, although a *good* blacksmith ought to know how to do it. Of course any electrician who has the necessary apparatus can charge them.]

A Galvanometer for Five Cents.

Editors Electrical Review:

Take a rectangular piece of wood—say, two inches long, one inch wide and one inch thick—and wind on it four or five layers of No. 20 insulated wire. Then, with a suspended magnetized needle over it, you have a galvanometer, which will indicate by the deflection of the needle a current of electricity passing through it. All of this need not exceed in cost five cents, but will prove of value to the amateur in electricity. Details, such as thin sides to the piece of wood, to keep the wire in position, strip of paper between the layers of wire, graduated circle of pasteboard, mounting on a block of wood with binding posts, etc., will suggest themselves as the work progresses. Instead of a suspended needle, a twenty cent pocket compass can lie on the coil, and thus give a more convenient and handier instrument.

I have found in my experiments that it is much better to make what I can bearing on electrical work. It not only saves a great deal of money, but leads to unexpected results. Professor Faraday performed some of his most interesting experiments and made great discoveries with the simplest things imaginable. A bit of sealing wax, blown egg and bit of paper furnished valuable material for study. Electricity is about the cheapest thing to be had for the money, and my object is to encourage the young student to persevere with things at hand, and not wait for means to procure expensive apparatus. Some of our most valuable inventions were worked up from models of the rudest construction. P. D. RICHARDS.

It is believed that great increase in economy and efficiency has been introduced by recent improvements in electric wires, and in no way more than by the researches of Prof. Geo. Forbes on this subject. Among his recent deductions he has completely upset the old axiom that the safe current should be proportional to the section—that is, to the square of diameter—of the wire. For the smaller sort of wires he shows that the square of the current should vary as the cube of the diameter, and for still smaller conductors that the current should vary simply in proportion to the diameter.

Telephonic News

⁂ The New England Telephone Company made a net gain of 137 subscribers in April.

⁂ The Russian authorities have recently placed telephones in all their public offices, and in the principal fortresses throughout the country.

⁂ Mr. S. J. Keese, superintendent construction of Telephone Company at Trinidad, W. I., arrived in New York on Saturday last. Mr. Keese reports a growing business at Trinidad and Barbadoes. The former place has 135, the latter 120 subscribers.

⁂ The Commercial Company's exchange at Troy, N. Y., has 1,085 subscribers, including West Troy and Cohoes. Mr. A. Seeley, the general superintendent, reports a favorable outlook for growth during the ensuing year.

⁂ Milwaukee Telephone Exchange has 1,210 subscribers. This exchange is now connected with fifty-two exchanges outside, which have nearly 5,000 subscribers. The officers are: C. H. Haskins, president; F. C. Biglow, treasurer; H. C. Haskins, secretary; G. E. Knight, manager, Milwaukee Exchange; A. S. Hibbard, superintendent State exchanges; W. B. Roberts, auditor; and S. G. Lapham, cashier.

⁂ There is now on exhibition at the law office of Mr. John P. Sunderland, in the Mechanics' Bank Building, a new acoustic telephone. It differs from other inventions of the same kind in the character of the vibratory membrane, which is made of several layers of woven material resembling hemp, or ligneous thread, which are kept together by means of what is claimed to be an indestructible paint. The transmitter and receiver are one, and the telephone is disc-shaped.

⁂ During the recent visit of Lord Randolph Churchill to Birmingham, England, a very interesting experiment was made with the telephone in connection with the Town Hall meetings. Mr. R. H. Milward, who resides at Bromsgrove, a distance of about twelve miles from Birmingham, conceived the somewhat novel idea of inviting a number of friends to his house to hear Lord Randolph's speeches by telephone. The experiment proved successful beyond the most sanguine expectations, for not only was every word of the speaker heard, but also every ejaculation by the audience, and by the tone of the voice the listeners had no difficulty in distinguishing who was speaking. There were three receivers used, one in front of each of the side galleries near to the platform, and one suspended at the corner of the chairman's desk, and immediately underneath Lord Randolph Churchill when he was speaking. At the other end four transmitters were used, so that four persons at a time could hear all that was going on at the hall.

The Providence Telephone Company held its annual meeting on Monday last. The stock was largely represented. The following abstract is made from the treasurer's report:

Capital stock, $200,000; plant, $197,873,-67; indebtedness, $18,098.01; profit and loss, $15,971.70; cash in the treasury, $2,136.31; increase of capital, $50,000; expended for plant, $34,265.43; paid royalty to the American Bell Telephone Company, $34,285.43; commission, $1,194.39; dividends, including stock dividends, $43,000; expenses, $40,203.03; cash on hand May 1, 1883, $1,424.15; cash on hand May 1, 1884, $18,098.01; gross earnings, $121,699.15; expenses, $75,662.85; net earnings, $46,-036.30.

The following Board of Directors were elected for the ensuing year: Henry Howard, Henry G. Russell, Henry C. Cranston, R. G. Hazard, 2d, F. H. Peckham, Jr., R. M. Larned, James H. Chace, H. F. Barrows, C. R. Greene, J. U. Starkweather.

The directors organized as follows: President, Henry Howard; Vice-president, Henry C. Cranston; Secretary and Treasurer, Chas. T. Howard; General Manager and Superintendent, J. W. Duxbury; Assistant Secretary, Henry Harris; Assistant Superintendents, J. H. Clark, A. C. White.

Annual Report of the Directors of the Southern New England Telephone Company, to the Stockholders—May 13th, 1884.

To the Stockholders of the Southern New England Telephone Company:

The directors beg to submit to the stockholders the following as their annual report for the business year closing March 31st, 1884.

We began the year with 4,594 stations divided among 30 exchanges. We closed the year with 5,615 stations, divided among 36 exchanges, an increase for the business year of 1,021 stations. Our plant on the 31st of March, 1883, stood upon the books $1,014,488.24; on the 31st of March, 1884, it stood $1,166,943.93, being an increase in our plant of $152,455.59, which represents cash expenditure. Of this amount $63,-272.68 has been expended in extra-territorial lines, making the total increase in the exchange construction account $89,183.01. The cash receipts of the company for the year have been $234,712.29. Its expenses have been $149,500.38. There have been paid $83,476 individends, and $1,735.91 have been passed to contingent account. This contingent account represents taxes. These amounts have been cash actually received. There remains on the books of the company on the 31st of March, 1884, $9,869.25 of uncollected bills. At the beginning of the first quarter of the year just closed the rental account was $42,409 50 per quarter. At the beginning of the present year it was $52,-153.27 per quarter. The extra-territorial account at the beginning of 1883 was $6,196.87; at the beginning of 1884 was $7,087.05. For further financial statement we refer to the summary of our balance-sheet, included in the treasurer's report, which is appended hereto. It will be seen by that that the indebtedness of the company is $38,692.17. To meet this indebtedness, and such other further expenditure as the reasonable administration of our construction account may demand, we have, unissued, $69,000 of capital stock. This the directors have not deemed it feasible yet to issue.

Regarding the service, we believe we may say that it has been fairly satisfactory during the past year. The last quarter of the year, ending March 31, 1884, was the most disastrous one in the history of the company, owing to very serious losses occasioned by the ice storms which visited both the southern and northern parts of our territory. Reconstruction in this quarter occasioned an additional expenditure of something over $7,000. This, of course, was occasional and accidental. Such destruction of wire property has never been known in this State in the history of the telegraph or telephone business. We can reasonably expect to be exempt from such a visitation for some time, but it brings to mind the fact that in this new business we have not yet been able to measure our cost of maintenance. Strictly, a reserve should be withheld every quarter for the purpose of meeting possible contingencies of this character. The policy of the company hitherto, however, has been to divide all its earnings quarter by quarter. The result of that policy has been that when the disaster came we were obliged to meet it from the current receipts of the quarter, and consequently to diminish that quarter's dividend by one-half of one per cent.

The business of the company has been uninterfered with by legislation in this State up to this point. The laws regarding the setting of telegraph and telephone poles were made somewhat more stringent at the last session of the General Assembly, but not to such a degree as seriously to hamper the business. We have had no serious attack upon our prices. On the contrary, it has been a grave question with the board of directors whether the lowest prices on our scale of charges were not too low, and it is under serious consideration whether any more orders will be taken for the thirty and forty dollar rates. The proportion of our subscribers who pay forty dollars a year or less is so very much greater than those who pay more, that the average result is not so large a return for the service rendered as to many of us would seem just. No action, however, has yet been taken by the board on this matter.

The relations of the company to the American Bell Telephone Company stand as they did one year ago. The permanent contract has not yet been executed, for it has not yet been presented to the directors in form by the American Bell Telephone Company.

In August of last year a stockholders' meeting was called, at which a vote was passed authorizing the directors to consolidate this company with the other companies in New England, upon terms which were then stated. After the passage of this vote the negotiations between the managers of the various companies and the American Bell Telephone Company took such form that the directors of this company deemed it unadvisable to exercise the authority given them, and therefore let the whole matter drop.

The growth of the company during the past year has perhaps been all that could be expected. It has been a growth entirely in our territory, without increase of area. We have purchased no exchanges but have simply increased the exchanges already existing, or enlarged into exchanges what were a year ago branch stations. The present flat condition of all business has, of course, been felt by us during the last few months in a checking of growth, but the result from quarter to quarter is still a net increase. Our extra-territorial business has occasioned a large outlay of money which as yet produces no income. We have been obliged to expend a great deal of money in preparation for the through business between New York and Boston, which we are not yet in condition to begin. We anticipate, however, that during the current year this department of the business will begin to render return.

All of which is respectfully submitted.

For the Directors,

MORRIS F. TYLER,
President.

TREASURER'S STATEMENT.

April 1, 1883, to April 1, 1884.

Cash receipts		$234,712 29
Sundry and general expense	$149,500 38	
Dividends	83,476 00	
Contingent & surplus	1,735 91	
		$234,712 29

COMPARATIVE STATEMENT OF RENTAL AND EXTRA TERRITORIAL ACCOUNTS FOR THE APRIL QUARTER, 1883 AND 1884.

1883.

Rentals	$42,400 50	
Rentals back due	5,672 02	
		$48,081 52
Ex. Territorial	$6,196 87	
Ex. Ter. back due	1,716 10	
		$ 7,912 97
		$55,994 49

1884.

Rentals	$52,153 27	
Rentals back due	8,206 24	
		$60,359 51
Ex. Territorial	$ 7,087 05	
Ex. Ter. back due	1,391 10	
		$ 8,478 15
		$68,837 66

An increase of $9,743.77 in rental account, and $890.18 in extra territorial account. But for the storms during the extra territorial quarter of 1884, our increase over the corresponding quarter of 1883 would have been nearly $1,300, or a total increase in income of over $11,000.

Plants, April 1, 1884	$1,166,943 93
Plants, April 1, 1883	1,014,488 24
Increase	$152,455 69
Exchanges, April 1, 1884	36
Exchanges, April 1, 1883	30
Increase	6
Stations	5,615
Stations	4,594
Increase	1,021

A. H. EMBLER, Treasurer.

TRIAL BALANCE SUMMARY.

April 1, 1884.

Capital Stock	$906,800 00	
Surplus	200,642 47	
Bills Payable	35,000 00	
Profit and Loss	26 15	
American Bell Telephone Co.	19,955 15	
Contingent	1,000 00	
Sundry Accounts	14,195 63	
Sundry Income	66,760 63	
Cash & in Bank		$8,863 02
Interest		498 33
Supply		13,792 73
Sundry Accounts		7,792 86
Sundry Expense		22,469 55
General Exp.		24,019 61
Plants		1,166 943 93
	$1,244,380 03	$1,244,380 03

A. H. EMBLER, Treasurer.

The Telephone Subscriber.

For ten years the writer has had more or less to do with subscribers to electrical organizations, he has walked his diurnal twenty miles, on a general news route; he has had to doctor burglar alarms which have been given up as incurable; he has had to persuade refractory landlords that the roof and wall fixture was a bountiful dispensation of an all wise Providence; and last but not least, he has had to placate the subscribers to an automatic fire alarm company, after their magnificent French plate glass front had been demolished by the forcible entrance of the Insurance Patrol on a false alarm, and, therefore, although no one who pays for a telephone will believe it, he has found that a certain modicum of the trouble attending the use of the telephone is produced by the subscriber himself.

There are almost as many genera and species of subscribers as there are of inspectors.

There is the good natured but careless subscriber. His distinguishing trait is that he always goes away and leaves the telephone off the hook.

There is the independent subscriber; he may always be known by the fact that he calls some other party, and then goes up to the fifth floor, so that when Miss Jennie Flexion calls him to say "all ready," he may be among the missing.

There is the subscriber who makes it a point never to answer the first ring. "It don't do to answer too quick, you know. They are paid to wait."

There is the forgetful subscriber who can never remember that the margin of every page of his telephone book is covered with such mottoes as "Please ring off when your conversation is over" "give the number of the party wanted," "don't converse with the operator," and so on. This subscriber is the one who always finds fault with the operator if she cuts in on his conversation, and asks if he is through; who frets and fumes if he thinks she is listening without saying a word; and who works himself up into a furious heat if she doesn't find out when he has finished with one subscriber and wants another.

There is also the impatient subscriber, who can never fully realize that he, and the two or three with whom he habitually converses, are not the only ones connected with the exchange; who heaps muttered objurgations on the operator, (who ten to one is doing her very best to answer calls promptly) if he has to wait twenty-five seconds for an answer.

There is the boisterous and ferocious subscriber, who always sends his preliminary

calls as if the magneto bell were a two four three four, six eight time hand organ, and he the Savoyard performer thereon, and paid by the turn. He will invariably snatch the telephone from its hook, as if he was afraid it would catch the cerebro spinal meningitis if it stayed there any longer; and when he begins to talk, he does'nt fail to yell in tones of thunder to the finely adjusted Blake, which of course gets all "broke up" under the infliction. The next proceeding of this fiery untamed individual is to poke the transmitter diaphragm facetiously with the end of his thumb or forefinger, apparently under the impression, that this in some occult way will wake the transmitter up to a sense of its iniquity. If he fails to make his correspondent hear, no matter why, he lays it all on to the much enduring transmitter, curses the inoffensive instrument, and hangs up his receiver savagely in a way that implies that he does'nt care now if it does take the cerebro, *et c tera*. It cannot be denied that this class of being has a certain amount of excuse for living. He has probably watched those who should have taught him better until he has acquired the idea that his method of procedure is eminently proper, and in fact the only method that can successfully be employed to get any kind of work out of the central office authorities.

He has watched the inspector come in, large as life, and go through these very motions, and slam and bang the instruments, utterly oblivious of the fact that electrical apparatus adapted for the transmission and reproduction of articulate speech is of a delicate nature, and demands delicate treatment. Who can wonder that he has copied the same modes of operation? I have seen the employes and clerks of a telephone company who, when they desire to call the central office, have only to remove the telephone quietly from the hook, grab at the instrument in the manner I have indicated, and if they have not instantly received a response, wax impatient and pitch into the service, which is, by the way, ordinarily good. I have heard them complain to the operator about the delay many times when it has not been at all unreasonable, and, if there has occurred any difficulty in making the distant station understand, they have made a point of poking the transmitter, just as if poking a transmitter was a proceeding of unalloyed delight to them, when ten to one the trouble was not in the transmitter at all, but in the other party's deafness, or in the condition of the line.

It is thus evident that to make a perfect telephonic service there must be co-operation. The subscriber must cheerfully be willing to perform his part; while the telephone company, and its officers and employes must make every endeavor to give prompt and efficient service; must be uniformly civil and obliging, even under provocation; and when complaint is made must lose no time removing the trouble; it and they will lose nothing by devoting a little time to educating its constituency; and the subscribers on their part must and will learn to aid in affording good and effective service, if it is politely but firmly insisted upon, and if it is persistently brought to their notice that such service depends fully as much upon themselves as upon those in charge of the exchange.

To this end it will pay, once in awhile, for some properly constituted authority to visit each subscriber and explain the proper methods of procedure.

I imagine some one saying here, "It is no use trying; you cannot teach a subscriber anything; they will do as they want to anyhow."

I have heard this statement repeatedly, and believe it to be a baseless generality. Both subscribers and telephone companies are doing much better now than they did at first, simply because they are more experienced, and this applies even more to the subscribers than to the operators, inasmuch as many of the former are still the same as at first, while very many of the early telephone employes have now left the business, being succeeded by new ones.

Let the subscriber fully understand that there is a place to hang the receiver, and that if he does not hang it there it is at his own risk; that he cannot be called, and that his transmitter battery loses its power.

Bring it clearly before him that if he talks with the operator he is likely to get her into trouble, and then if he is half a man he will surely refrain. Tell him why it is best to give numbers instead of names; that it enables the operator to serve him quicker, and that if it is too much trouble for him to look them up in his book, it is a good plan to pick out the numbers he wants most frequently, write them on a card, and hang the said card up near his telephone. Let him see that if he will condescend to "ring off," he can accelerate his own business and at the same time diminish the "Are you through?" nuisance. Instruct him orally as well as by the book, that the exchange sometimes has other subscribers besides himself and his immediate friends; that the operator frequently has a hundred or so lines to attend to, and that it is within the bounds of possibility that half a dozen calls may occasionally come in at once. He will then slowly but surely learn to curb his angry passions, and to refrain from savagely reprimanding the hard-working operator if she does not respond for seven-tenths of a second.

Show your clients, both by example and precept, that in telephony the easiest way is the best; that he will meet with much better success, and obtain better service, if he would treat the telephone apparatus as being in some measure a reasonable piece of mechanism, not easily influenced by ferocious jerks, or propitiated by facetious pokes; that once in a while he may be too near to the transmitter; that his line is not and cannot be built for eternity, and that the trouble may be at the receiving end; and that if he copies the inspectors, to be careful and copy the good ones only. If these instructions, and others which will naturally suggest themselves to the manager, be put into practice, the result cannot fail to be beneficial.

I omitted to mention the inventive and experimental subscriber in the above recapitulation. He is as bad as an inventive or experimental inspector; worse, almost, as after he has put things wrong he has no way to put them right again. It is not necessary to reflect upon this species. He only needs to be known to be appreciated. We all know him. We all appreciate him.

THOS. D. LOCKWOOD.

Tried and Not Found Wanting.

Among electricians and those connected with the various telephone companies, very much interest has been felt in the success of the copper metallic circuit, which, about two weeks since, was completed as a telephone line between New York and Boston, after a period of labor in placing in position which has occupied nearly all winter. It differs from the old lines in that two copper wires are employed, instead of taking a ground circuit. This has the effect of removing all the induction, which, all along, has been the principal drawback in long telephone lines. The idea of this copper metallic circuit originated with Mr. T. B. Doolittle, of this city, who occupies the position of special agent of the eastern district of the American Bell Telephone Company—the eastern district embracing all of New England—and who is, in matters of telephonic appurtenances, an authority; under his superintendence, in fact, the line has been completed. Owing to Mr. Doolittle's ideas upon the subject, Bridgeport has the honor of being the first city in the United States which used hard-drawn copper wire for telephone lines, one being placed by him for the local circuit about six years ago.

Since the circuit between New York and Boston was finished, one or two tests have been made, and they were most satisfactory; but, until to-day, no official inquiry into the success of the scheme has been made. This morning the officers of the Bell Company met in New York, and Mr. Doolittle was notified that an official test would be made. In order that it might be certain that the line was in perfect order, a loop in the circuit was made, the wires brought into the telephone exchange in this city, and yesterday morning a special test was made here. First New York was tried, and afterward Boston. A representative of *The Farmer* was permitted to talk with these places, and was greatly surprised at the result. From both points the words of the operator, during a somewhat extended and rapid conversation, were borne to the ears of the listener with perfect distinctness, and the gentleman at Boston remarked that it seemed to him as if the speaker here were merely across the street, so plain were the words. An ordinary Blake transmitter was employed at the local exchange, the same as is used by all subscribers, and the same was used in New York and Boston part of the time, a Hunning transmitter being also employed at the latter place with equally good results. The informal test was really of great importance, as it demonstrated very decidedly the perfect success of the metallic circuit, which will, in time, probably supersede all others, and is one of the momentous components, it seems, necessary to render long distance telephoning a practical success. —*Bridgeport Farmer.*

The Telegraph Lines of South America.

In South America the only Republic without a telegraph is Ecuador. Chili and Peru have had lines many years. Colombia only commenced hers within a few years, also Venezuela. The U. S. of Colombia now possess a network of many thousands of miles. A tender for the construction of about 500 miles of line, running from the town of Panama towards the border of Costa Rica was solicited by the Government at Bogota. But up to date no one has appeared desirous of obtaining the contract. The terms offered were not favorable, while the credit of the Government is not free from reproach.

The Central and South American Telegraph Company's lines run from Vera Cruz in Mexico, to Lima in Peru. At Vera Cruz they connect with the lines of the Mexican Telegraph Company, which run to Galveston, Texas. Mr. James A. Schymser is President of the two companies. At Lima the Central and South American Company's wires come into connection with those of the West Coast of America Company, whose terminus is at Valparaiso, in Chili.

The Central and South America Company's lines comprise 3,169½ miles of cable, 300 miles of land wire, and connect exclusively with 2,800 miles of submarine cable and 20,000 miles of land wire in Mexico and Central and South America. The distance between New York and Valparaiso is 7,750 miles.

The route of the company's cables is Galveston to Coatzacoalcos *via* Vera Cruz and Tampico, thence by land line across the Isthmus of Tehuantepec to Salina Cruz in the Pacific. From this point to Callao in Peru (the port of and nine miles from Lima, the capital of Peru); the stations are consecutively La Libertad (Republic of Salvador), San Juan del Sur (Nicaragua), Panama (U. S. of Colombia), Buenaventuro (U. S. of C.), Santa Elena (Ecuador), Payta (Peru) and Callao.

The whole work on the Central and South American Company's lines was completed in eleven months, an achievement unprecedented in the history of ocean cables for its rapidity.

The cables were laid by the India Rubber, Gutta Percha and Telegraph Works Company, of Silvertown, London.

The land line of 115 miles from St. Elena to Guayaquil, in Ecuador, was finished at the end of August, 1883. The line across the Isthmus of Tehuantepec, from Coatzacoalcos to Salina Cruz was finished on August 15th, 1882. Mr. J. R. France is the General Manager of the Company at Panama, and Mr. Frederick Davies at Lima. —*Canadian Electrical News.*

*** The Bell Telephone Company, of Buffalo, gained 120 subscribers, net, during the month of April, giving a total of 2,733 stations connected May 1st. They will pay the usual quarterly dividend of one and one-half per cent., after providing for construction out of the net earnings.

TELEGRAPHIC

.... The cable between Key West and Havana is broken, and messages between those two points are passed over by steamer about once per day.

.... The Western Union Telegraph Company is circulating petitions among business men asking Congress not to interfere with the business of the telegraph companies.

.... A London dispatch says that the shares of the Atlantic cable companies forming the present pool are noticeably affected by the new transatlantic enterprise of the Commercial Cable Company, and fluctuate daily according to the progress reported made by the steamer Faraday in laying the new cable.

.... Stock for a new cable has been largely subscribed for in Copenhagen It is proposed to start from Thurso, in Scotland, from there to run to the Faroe islands, and thence to Iceland; from Iceland to the west coast of Greenland, from whence it would dip southward to Lawrence Bay, striking the American continent finally at Gaspe Harbor. The total length of the cable is to be 3,150 miles. The longest section will be under 900 miles, and it is anticipated that for that reason it will do the work of any two of the cables now uniting Europe with America.

....The current number of the *Telegraphic* contains an account of a trial of the wonderful capabilities of the Indo-European line. Connection was successively made to Emden, to Odessa, to Teheran, to Kurrachee, and finally to Calcutta, and through this enormous length of 7,000 miles of wire messages were sent and received directly with an ordinary Morse printer at the rate of 12 or 14 words a minute. This is a marvelous improvement on the time when messages were a week in transit. In 1866 only one message got through in 24 hours.

.... Canadian Pacific Railway Company's telegraph offices are now opened at the following points east of Port Arthur: McLean's, McKenzie, Coon Lake, McVicar's Camp, Pearl Siding, Wolf River, Sturgeon River, Red Rock, Nepigon Bridge, Mazoukamah, Gravel Bay, Tunnel, Pay's Flat, McKay's Harbor, Winston's Dock, Isbesters Camp, Jackfish Bay, Sleepy River, McKellar's Harbor, Little Pic, Port Caldwell, Red Sucker Cove, Port Munro, Peninsula Harbor, Pic, Cache Lake, Forbes and Stevenson's Camp, White River, Halfway House, Michipicocton, Pike Lake, and Dog Lake.

.... Trials have recently been made at Berlin of dynamo currents for the working of the telegraph lines, and have proved quite successful. The current was furnished by a continuous current Siemens machine having its electro-magnets excited by a small dynamo. The machine had a difference of potential of 40 volts, and supplied twelve subterranean and two aerial lines with Hughes' apparatus, together with eleven subterranean lines and twelve aerial lines with Morse apparatus, and lastly, three lines on closed circuit. It was found that the work could be done very well on lines which required from 25 to 80 cells to work them; and that there was a slight gain of speed on the subterranean lines.

.... The Boston Mutual District Messenger Company held its annual meeting in Boston on Saturday, 17th inst. The following elections were made: James M. Prendergast, president; Allen S. Weeks, treasurer; Parker C. Chandler, corporation counsel; D. J. Hern, general manager. Directors: Gen. Thomas T. Eckert, Charles A. Tinker, H. W. Pope, of New York; Parker C. Chandler, Frederick L. Ames, D. J. Hern, James M. Prendergast, Allen S. Weeks, Thomas Roche, of Boston. The company has collected and delivered 1,500,000 telegrams in this city, exclusive of letters and packages that were also delivered. The earnings of the company for the eleven months previous to May 1 were $83,229.76. The company has no debts. A second quarterly dividend at the rate of eight per cent. per annum was declared payable. The company at present employs about 300 messenger boys, and has seventeen offices open for business.

ELECTRICAL AND SCIENTIFIC

* * A prize of $2,000 has been offered by the Italian Government for the most practical process for the transmission of electrical energy.

* * The consumption of copper in the United States in 1872 was 34,000,000 pounds. Since that time it has steadily increased. Last year it was 80,000,000.

* * It is said that an electric railway will be one of the attractions at the Exhibition of the New England Manufacturers and Mechanics Institute next fall.

* * The result of invention: In 1868 steel rails were $165 per ton; in 1884, $34 per ton. The difference in the price of one year's production would be $168,446,200.

* * Several very brilliant displays of the aurora borealis were seen in the north of Scotland early in the present month. Earth currents were observed on several wires.

* * The Franklin Institute of Philadelphia will exhibit during the coming electrical exhibition, as complete an exhibit as possible of all publications new or old, pertaining to electrical science of this and other countries.

* * The annual literary prize of 25,000f., instituted by the King of the Belgians, will, for 1885, be granted to the author (Belgian or foreign) of the best work on the means of popularizing the study of geography, and developing it in the different educational establishments. The works of competitors must be sent to the Belgian Minister of the Interior before January 1, 1885.

* * The London *Plumber and Decorator* remarks that the following are said to be the sixteen American inventions of world-wide adoption: The cotton gin, the planing machine, the telegraph, the grass mower and reaper, the rotary printing press, steam navigation, the hot-air engine, the sewing machine, the india-rubber industry, the machine manufacture of horse shoes, the sand blast for graving, the gauge lath, the grain elevator, artificial ice-making on a large scale, the electric magnet in its practical application, and the telephone.

* * Mr. R. T. Glazebrook, of the Philosophical Society, Cambridge, has made a comparison of Maxwell's equations of the electro-magnetic field with those of Helm holtz and Lorentz. He points out that the main difference between the two theories turns upon the fact that, while Maxwell considers the electric displacement throughout the entire field, Helmholtz deals with the electric moment of each element of volume, supposing that by the action of the inducing force opposite electricities are driven to opposite ends of each element. Maxwell's displacement corresponds to the induction in the magnetic field; Helmholtz's polarization to the induced magnetization.

* * The modern kinetic theory of gases, says Professor Tait in offering a suggestion as to the source of atmospheric electricity, shows that the particles of water vapor are so small that there are somewhere about three hundred millions of millions of millions (a truly vast number) of them in a single cubic inch of saturated steam at ordinary atmospheric pressure. This corresponds to 1-1600 or so of a cubic inch of water, *i. e.*, to about an average raindrop. But if each of the vapor particles had been by any cause electrified to one and the same potential, and all could be made to unite, the potential of the raindrop formed from them would be fifty million million times greater. Thus it appears that if there be any cause which would give each particle of vapor an electrical potential, even if that potential were smaller than any that can be indicated by our most delicate electrometers, the aggregation of these particles into raindrops would easily explain the charge of the most formidable thunder cloud.

* * There are two little machines used in the manufacture of watches, at Danbury, Conn., which cut the threads on screws one-eighth of an inch long, and of which it takes 200 to weigh an ounce. They have been working about a month, and each machine makes 5,000 screws a day.

* * At the closing of the Electrical Conference in Paris, May 5th, M. Cochery, Minister of Posts and Telegraphs, in making the closing address said that the labors of the conference for determining electrical units, which had just terminated, would extend and develop electrical industry and be ever memorable in the annals of electrical science.

The annual report of the Minister of Public Works of the Dominion, submitted to Parliament, contains statistics showing that so far as government management of telegraphs is concerned, a very unfortunate result has been reached. The lines built have cost nearly $800,000. The expenditure last year was $55,000, while the receipts were only $27,000, showing a loss of over 50 per cent. It is true that many of these lines are in remote quarters, but even a perfect system, such as that taken over from the Western Union Company in British Columbia, shows a similar result. These lines cost $94,000; the expenditure last year was $35,000, while the revenue was only $24,000, showing a loss of $11,000. The appendix contains figures from the lines owned by the Great North Western Telegraph Company. The number of telegraph offices in connection with this and other private lines in Canada is 2,259, or one office to every 1,914 inhabitants, while in the United States there is only one office to every 2,700 persons.

Electric Light Conductors.

In view of the introduction of the electric light on a large and general scale, the size, form, and material of the conductors employed to convey the currents are very important considerations; and it is fortunate for electric engineers that so competent a member of their body as Professor George Forbes has taken up the subject. Professor Forbes brings to the study of the question not only his electrical experience, but his knowledge, as a physicist, of the laws of cooling. The problem is in the main a physical one, at least so far as regards the current which a given conductor will carry without overheating; but questions of economy and practical convenience come into play when the kind of material and the best form that can be given to it are to be considered.

One of the erroneous notions swept away by Professor Forbes is that the current should be in direct proportion to the sectional area of the conductor, a notion which is the foundation for all the practical rules in use for making the number of amperes to be carried proportional to the cross section of the conductor. Such a rule, for instance, is that of the Fire Risks Committee of the Society of Telegraph Engineers, now adopted by our insurance companies. This rule lays it down that a current of 1,000 amperes per square inch of sectional area is a safe current. Like this, Sir William Thomson's rule is also defective for conductors of a large size, however correct it may be for small installations.

Former experiments by Professor Forbes and others on the smaller sort of wires have shown that the current square should be proportional to the cube of the diameter of round wires, and recent experiments of his on some small wires show that the true relation is more nearly that the current should simply be proportional to the diameter.

In a recent communication to the Society of Telegraph Engineers and Electricians, Prof. Forbes has considered all the cases of electric lighting conductors, that is to say: Overhead bare wires, overhead covered wires or cables, subterranean cables, subaqueous cables and coils.

It is difficult to get experimental data in this subject, but we give a rule which has been brought out by experiments of Messrs. Clarke, Forde & Co., the well-known electrical engineers. The rule is that a safe current may be sent through either a bare or an insulated wire at the rate of one ampere for every 10 lbs. of copper per mile. Mr. Andrew Jamieson has for some time past employed a rule for shipbuilding leads of 1,000 amperes per square inch sectional area, and 1,000 ohms resistance of insulator per mile for every volt of electromotive force driven by the current.

Professor Forbes, however, gives a formula for the relation between the diameter of a bare overhead conductor and the current which it can safely carry. It is:

$$C^2 = D^3 t \frac{\pi^2 H}{4 R \times 0.24}$$

where

C = current in amperes.

D = diameter of the conductor in centimeters.

t = excess of temperature of conductor above the air.

H = coefficient of radiation and convection = .0003.

R = specific electric resistance of the conductor.

This value of H is based on experiments on radiation made by Mr. Donald Macfarlane in 1869. The constant 0.24 is the number of gramme centimeter heat units in a Watt.

With regard to safety fuzes of lead wire, Professor Forbes has made many experiments, and finds that a short fuze requires a much stronger current to fuze it than a long one. The reason of this somewhat paradoxical result is, in the opinion of Professor Forbes, that the stout metal terminals or contacts of a fuze conduct the heat away more rapidly from a short than a long fuze.

Passing next to covered wires, Professor Forbes finds that for aerial insulated cables of gutta-percha and india-rubber:

$$C = \sqrt{\left(\frac{\pi^2 k D_1^2}{.48 R} . t \times \frac{3 D_2 \log \frac{D_2}{D_1}}{10 + 3 D_2 \log \frac{D_2}{D_1}}\right)}$$

Where

D_1 = diameter of conductor.

D_2 = diameter of insulated cable.

t = excess of temperature of conductor over the air.

k = heat conductivity of insulator: for gutta-percha = .00048; for india-rubber = .00041.

Professor Forbes arrives at the conclusion that heat is dissipated *more easily* from insulated wires than from bare ones, even though, as in the case of gutta-percha, the covering material is a bad conductor of heat. This theoretical result is fully borne out by experience; and it may be taken that in insulated cables the safe current is not *less* than in naked wires of the same diameter of conductor. This result is due to the greater radiating surface of the covered wire over the bare one. Fourier has shown that after a certain time there will be a steady flow of heat out of the insulator, which will give off exactly the same amount of heat it receives from the wire. Until this limit is reached, however, the heat generated is partly absorbed by the insulator to bring it up to the limiting temperature. While this process is going on, the wire will actually carry a larger current than it will afterwards when the limiting temperature is reached, and the inflow of heat into the insulator is equal to the outflow. A patent has been taken out for thin wires covered with a thick coating of plaster of Paris, which seems to depend on this power of absorption of the insulator to keep the wire cool, but plaster of Paris is apt to become conducting at a high temperature, and, though one purpose might be gained by the use of such wire, the loss of current by leakage would tell in the opposite direction. At a depth of two feet under the ground the daily variation of temperature is hardly felt; and hence, if we suppose a subterranean conductor buried at this depth, the surface temperature would not affect the problem. All its heat would in the end rise towards the surface, and heat that. If we suppose a rise of surface temperature of 10 deg. cent. permissible, then Professor Forbes calculates that a flat copper conductor, one centimeter thick and 2,800 centimeters broad, would carry a current of 70,000 amperes, which is sufficient for a very large installation. The depth at which it is laid is here supposed to be anything less than two feet, and the rise of temperature 10 cent. at the surface of the ground.

The great mass of copper would be very expensive, and, though the flat shape is the most desirable on account of its cooling properties, the material of such large mains ought, in Professor Forbes' opinion, to be iron, not copper.

With regard to the last of the cases considered by Professor Forbes—namely, coils—such as the coil of a dynamo, he finds that the safe current which can be carried with a rise of 50 deg. Cent. is:

$$C = .25 \times \sqrt{\frac{S}{\rho}}$$

where

S = the surface radiating heat.

ρ = the resistance of the coils.

This, however, does not apply to armature coils which are cooled by air currents due to their rapid rotation.—*Engineering.*

Electrical Patents.

Mr. T. J. Handford communicates the following to the London *Electrical Review:*

It must be matter of common observation to any person who attentively watches passing events in the scientific world, that there are epochs or periods of time when an impetus is given to invention in some particular line, so that the ingenuity of a great many minds is concentrated on one subject, and a large number of patents are taken out for improvements in connection with it. Such an epoch was that which marked the invention of roller skates, and again that which heralded the introduction of bicycles, and more recently those which marked the invention of the telephone and the development of the electric light.

During the last six or seven years, since the publication of the telephone and the practical application of electricity to illuminating purposes, a phalanx of minds has been teeming forth invention after invention in such rapid succession as to call forth expressions of astonishment at the almost boundless range of the inventive faculties when once they are directed to the accomplishment of any special object. For, this stream of invention has not been confined to the subject of the telephone and the electric light, but has extended itself to the various branches of electrical science, so that from its ramifications we have had improvements in dynamo-electric machines, magnets, induction coils, electro-motors and locomotion, electrolytic cells, and electrical apparatus of almost every other description. The subject has indeed been a prolific one, as the archives of the Patent Office plainly show; but notwithstanding the best of patents that have been taken out, it is greatly to be questioned whether one-fifth of the number would stand the ordeal of litigation. This crucial test of judicial scrutiny, if applied to existing patents on electrical subjects, would most probably result in the failure of four-fifths of the whole number to come up to the required standard.

But it may be asked, what are the causes of the invalidity of so large a majority of the patents which are constantly being taken out for alleged improvements in electrical apparatus? We might name several, such as defects in the specifications, either in the way of inaccuracy or insufficiency of description or impropriety in the claims, or an unknown prior publication, or use of the things patented; but probably the principal reason why so many patents are taken out which are intrinsically worthless is because inventors generally have such very erroneous ideas on the subject of what constitutes a patentable invention.

Persons think that the most obvious suggestion is patentable if it has never been done "before." It occurs to one that it would be convenient to put a telephonic transmitter and receiver together into one small case provided with mouth and ear pieces, and he takes out a patent for it! Another thinks it would be desirable to use in the receiver bifurcated flexible tubes, carry-

ing ear pieces, one for each year, and patents *that*. Again, A discovers a method of effecting a given object with the aid of a permanent magnet, and patents it. B seeing that A has not included in his specification the use of an electro-magnet as an alternative, patents it; and C perceiving that neither A nor B has described that a solenoid or sucking magnet may be employed for the same purpose, patents *that;* B and C overlooking the fact that the use of a certain device for a given purpose being known, a valid patent cannot be obtained for the use of the known equivalent of such device for the same purpose where no additional invention is involved in the application of the equivalent. It follows, therefore, in the majority of cases, that A's patent is confined to the use of the permanent magnet, as from want of foresight he has omitted to include its equivalents in his specification, and B's and C's patents are bad, whilst the public are entitled to use their contents, which A, had he been properly advised, would have included in his own patent.

Of course the doctrine of "equivalents" must not be pressed too far, as there being "nothing new under the sun," it would be impossible to trace an analogy to something previously known in the most novel invention which has ever seen the light, but without any such far-fetched or strained application of the doctrine, there is no doubt that inventors, as a rule, are too prone to jump to the conclusion that the most obvious expedient or equivalent may be patented if the identical thing has not been actually used or published; notwithstanding that something, which is the same to all intents and purposes, having the same object and accomplishing the same result by substantially the same means, is well known and possibly largely adopted, a mistake which is frequently only discovered after the patentee has committed himself to a large outlay and sunk a considerable sum of money in a worthless enterprise.

Electrically Lighted Trains.

Everybody who has ever tried to while away the tedious hours of a railway journey by reading is aware how unsatisfactory is the light furnished by the oil lamps. We have made rapid strides in railway accommodation of recent years. We have the most comfortable chairs, loungcs and beds, but the old-fashioned "farthing dip," so to speak, for the oil lamp is little better, yet remains.

The success which has attended the efforts made recently in England with electrically lighting railway coaches should not be lost upon here. The London, Brighton and South Coast railway, we learn from a contemporary, have had the electric light in their Pullman cars for some time past, and the experiment has proved so successful as to warrant the purchase by the company of the accumulators and plant required to supply them. Seventy of these have now been in use for eighteen months, and we have the same authority for saying that seven only have proved defective. In the first experiments twenty-two accumulators were charged by a Siemens D_2 dynamo worked off the axle of one of the carriages; but now a battery of twenty cells is charged with the current of a Brush machine. The use of batteries on this description of work, though more expensive, is likely to prove far more convenient than is the system of generating the light directly from a dynamo attached to the locomotive, because, in this case, the uncoupling of the engine is followed by the extinction of the lights. In this country, especially where there are such a vast number of roads, and where even a through train must needs, upon arriving upon the territory of another company, chagne locomotives, the adoption of this system of supplying the lights from the locomotive would make it imperative that every road adopted the same system, and this, of course, would be likely to prove impracticable, and even then would supervene intervals of total darkness which could not be tolerated.

Now, on the other hand, where primary or secondary batteries were used, the amount of energy already on hand would readily serve to keep all the lights going until the trains had been re-arranged or re-coupled. Just which of the two batteries is best for this purpose has not, so far as we can learn, yet appeared. The primary battery, as we know, requires neither engine nor dynamo to charge it, and can be fed with little more trouble than would be occasioned in filling an oil lamp. In the system known as the "Holmes-Burke" there is a siphon tap and filler which makes the filling up very simple, but, on the other hand, the plates require re-amalgamating twice each week, the battery lasting ten hours without re-charging. Each cell has an electro-motive force of 1.85, and an internal resistance of $\frac{1}{10}$ ohm. A battery of fifteen cells made up in three series of five cells will maintain nine incandescent lights of five-candle power each.

An account says: "In a carriage of six compartments two lights were placed in one and a single light in the others, while two were also placed in the guard's van and a very good light was obtained. The experimenter was of opinion that at least two lamps should be placed in each compartment so that should any accident happen to one the other may serve to keep the compartment lighted. Nine of the Holmes-Burke cells will sustain six five-candle-power lights for six hours at a stretch."

The question of cost in primary batteries is as yet a very indeterminate one; and further trials for a more extended period are necessary to enable us to see how it compares with other methods of lighting trains. Until this point is satisfactorily set at rest the advantages of primary battery lighting will be heavily handicapped, and, as regards secondary batteries, until they can be supplied at a moderate cost and can readily be worked by persons not specially educated for the purpose, it is not reasonable to suppose that they will be very generally adopted outside, at least of parlor coaches.

To revert once more to direct lighting—that is having a dynamo upon the locomotive, some very interesting experiments have recently been made in England, which go to show that electricity can be furnished to railway trains at a cost much less than gas; indeed these experiments showed that it could be furnished at nearly thirty per cent. less than gas, at about two dollars and a-half, our money, per 1,000 cubic feet, while at the same time furnishing nearly twice as much light. This large cost of gas includes the delivery aboard trains.

The total weight of the gear, including one ton of water in the boiler and tanks, two hundred weights of coal and the driver, was under three tons. The dynamo was a Siemens S D^1 self-regulating machine, capable of driving 120 high resistance of lamps, but in the present case it was run at only 530 revolutions per minute. This gave sufficient current for 52 Swan lamps (50 volts) of nearly 20 candle-power each. An account says:

"These lamps were distributed over the whole train, 30 being in the carriages and 20 in the machinery van. There were three lamps in each double first-class compartment, one in each second and third-class compartment, and the head and tail lamps were also lighted by electricity. The twenty lamps in the van were to bring the total number up to about fifty, which is the number required by an average train. The lamps were of 16 to 18-candle power, and were lit at first for 8½ hours each day, and afterwards for 6½ hours. The connecting wires were run in a cable laid in a wooden troughing placed along the roofs of the carriages, and they were permanently joined, as the carriages were never uncoupled. To avoid loose connections, due to vibrations, spring contacts were employed in addition to the ordinary ones. The Willans engine and the dynamo with switches were placed in an auxiliary van near the engine. At the end of fifteen days it was found that the boiler required cleaning, but after this had been done the experiment was continued, and always with success. Only one hitch occurred, when a passenger removed a lamp bodily, and only seven lamps failed."

This shows, beyond peradventure, that electrically lighting moving trains is not only practical, but, if the figures given may be relied upon, that railway cars may be sufficiently lighted to enable passengers to read without straining their eyes, at a cost to the company much less than gas.

Now is the time for an enterprising railway management to set an example.

The Mho-Meter.

Our esteemed contemporary *Engineering* says that the "mho" is Sir William Thomson's somewhat fanciful but useful term to mean the unit conductivity or reciprocal of the unit resistance; that is to say, $\frac{1}{\text{ohm}}$. It is useful in measuring the conductivities of short lengths of wire, such as that of low-resistance dynamo armatures. It is difficult to get practical electricians to measure 0 001 ohm, but with the mho-meter they can measure the reciprocal of this, or $\frac{1}{1000} = 1000$ mhos. In other words, it can measure the conductivity, and hence the resistance of a few feet of copper wire. It is a modification of Thomson's original paddle-wheel galvanometer, and has two fixed coils with a movable one suspended between them by a silk fibre, and carrying an aluminium pointer to indicate the deflections on a horizontal scale. The central coil is connected in circuit with the wire to be measured on a battery, and the tangent of the angle of deflection multiplied into the constant of the instrument gives the "mhos" or reciprocal of the resistance of the wire with great accuracy.

The battery may be a standard tray Daniell cell, made of a shallow square dish of clean copper 6 in. by 6 in. and 1½ in. deep, in which is fixed about ¾ in. from the bottom a flat plate of zinc having ½ in. clear between it and the copper. Sulphate of zinc solution of specific gravity 1.02 is poured into the copper dish, and then a quantity of saturated solution of sulphate of copper gently poured in at the side so as to fall to the bottom by its superior weight and raise the zinc solution above it into contact with the zinc plate.

Such a cell, carefully made, gives an electromotive force of 1.072—5 volts. Sir W. Thomson has also improved his well-known voltmeter, which consists of an astatic system of two magnetic needles, each encircled by a single wire coil, and suspended between two pairs of N. and S. magnetic poles placed one above the other in line with the needles, the N. pole of the fixed magnets being opposite the S. poles of the suspended magnets With such a cell the new voltmeter gives twenty-two divisions deflection of the aluminium pointer attached to the needles.

* * The annual meeting of the Electric Railway of the United States took place at the office of C. W. Rogers last Monday. After the report on last year's business had been presented, the following board of trustees were elected for the ensuing year: Grosvenor P. Lowrey, Sherburne B. Eaton, R. M. Gallaway, Thomas A. Edison, Simeon G. Reed, R. E. Deyo, Stephen Dudley Field, Charles W. Rogers, W. H. Meadowcroft, and George S. Scott. At the meeting of the board held afterward, Stephen D. Field was elected vice-president, W. H Meadowcroft secretary. The other offices were left vacant.

* * During a recent thunder storm which raged with great force at Greenville, R. I., lightning ran by the telephone wire to the Windsor Mill. There is no telephone in the mill, and the wire is disconnected just outside the building. The fluid was led by the wire to the corner of the mule and weaving rooms, and entered the building under the jet. It followed the water-pipe and set the sprinklers going, and at the same time fired the stock in the mules. By this singular provision of an active extinguishing agent at the moment the fire started serious loss was prevented, as the fire was soon drowned out.

ELECTRIC LIGHT NEWS

—— The annual meeting of the American Electric and Illuminating Company takes place in Portland, Maine, Saturday.

—— An electric light company has been organized at Gloucester, Mass. William Thompson was elected president, and Charles S. Tappan treasurer.

—— Mr. M. Lee Ross, of the Royal Electric Company of Montreal, is now in St. John, N. B., and will have the electric light in operation there within a week. Power will be obtained from some of the city establishments, or, if necessary, the company will furnish their own engines and boilers.

—— The Brush Electric Light Company, of Buffalo, N. Y., having secured a large contract for street lighting, are building a new station with a capacity of 600 lights. It will be equipped with ten 90-light dynamos, driven by ten independent engines of 65 horse-power each.

—— The Armington & Sims Engine Company is at work on an entirely new pattern of engines, designed especially for electric light purposes, more particularly for use on shipboard, where economy of room is a most important consideration. These engines will be upright in form, and will have the same characteristics as to high speed and regulation as the well known horizontal engines now made by this company. Six of these new engines have been ordered by the Edison Company for use on vessels here and in Europe. They will be of fifty horse-power each. There have also been ordered several of these new style engines of 150 horse-power each for use in the Paris central lighting station of the Edison Company, which is now furnishing over 8,000 lights.

—— The Brooklyn Board of Aldermen, on Tuesday last, rescinded a resolution passed a week ago giving two electric light companies the privilege to erect poles and wires in the Eastern and Western Districts of the city. The resolution was rescinded at the suggestion of Mayor Low, and the same general privileges were accorded the companies in another resolution, which, however, contains terms much more advantageous to the city. Each company is to furnish free to the city four lights, each of 2,000 candle-power, and one light free for every 30 furnished to private consumers. Lights furnished to the city shall be charged for at a rate not to exceed 70 cents a night for those of 2,000 candle-power, and not to exceed 15 cents per light for those of 16 candle-power. The companies also bind themselves to furnish 2,000 candle-power lights to private consumers at a price not exceeding 75 cents a light and 15 cents for 16 candle lights.

—— Arrangements for introducing the electric light at East Boston, Chelsea and Revere Beach, Mass., have now been perfected. The American Electric and Illuminating Company has closed a contract with the Shaw heirs of New York, for the purchase of the property known as the William Woolley wharf, on Condor street, near the Meridian street bridge. Here the country proposes to construct a central lighting station with a capacity of 200 to 300 lights, fitted up with the best boilers, engines and other machinery and a complete Thompson-Houston lighting plant, and to run the wires thence to the business centers of East Boston and Chelsea. The company has also purchased from Mr. John C. Miller, the proprietor of the Oak Island grove at Revere beach, land and building for the purposes of a sub-station, which will supply electric lights to Mr. Miller's extensive property, as well as to other beach resorts during the summer season. Both stations, when completed and in operation, will be turned over to the Union Electric Light and Power Company, which will carry on the lighting business, and which starts off with at least 100 lights assured. The stock of the new company is nearly all subscribed, and assurance is given that the balance will be taken and the books closed at an early date.

Galvanic Remedy for Boiler Corrosion.

A recent issue of *Iron* contains a description of a method invented by a Mr. Hannay for preventing corrosion in steam boilers. Taking certain primary facts, and experimenting by their light, he deduced the theory that thermo-electric currents were set up between the colder and hotter parts of the boiler, and that the colder part, forming the positive pole, corroded by the natural law of galvanic action, and this theory he succeeded in proving to be an ascertained fact. For the prevention of this action Mr. Hannay uses a ball of zinc, with a copper conductor cast through the center of it, the copper being so combined and amalgamated with the zinc at the junction of the two metals as to form brass, and thus no corrosion can form between them to stop the galvanic current. This ball of zinc is fitted in any convenient part of the boiler by a simple device, and a wire from each end of the copper conductor is soldered firmly to the iron. "From that moment the electrogen keeps up an uninterrupted galvanic current, and the whole of the interior of the boiler is absolutely protected from corrosion so long as any of the zinc remains. A further gain, perhaps even greater than these, is that it is said not to allow scale to form in a boiler at any time to a much greater thickness than that of an egg shell or a coat of paint. In consequence of the intensity of the current, a portion of the water is slowly decomposed, and the hydrogen that is evolved at the negative pole all over the iron and underneath the scale forces off the scale in thin flakes by mechanical action as soon as it becomes thick enough to be impervious to the hydrogen."

If the water can get under the scale to be decomposed, why do not the bubbles of steam which are constantly forming on the heating surface of boilers force it off by "mechanical action?" We shall expect to see a galvanometer beside the steam gauge of well regulated boilers hereafter.

The St. Louis Wire Mill Company are in negotiation with Jacob Reese, of Pittsburgh, with a view of securing a right to manufacture wire by his improved method. By the Reese process it is claimed that barbed fence wire can be made without annealing, pickling and washing, thus saving the cost of fuel in annealing, acids and loss of metal in pickling and alkalies in washing off the acid. The saving is said to be from three to five dollars per ton, according to the size of the wire produced.

The cities of Georgia seem to be in a very thriving condition. In Atlanta there are $2,000,000 worth of new buildings in the hands of contractors, besides the new capital, which will be started this spring. In Macon contracts for over $500,000 worth of new buildings have been closed out. Columbus has had $200,000 worth of residences erected since last summer, and about $300,000 worth of work engaged for the coming season. In Savannah $1,000,000 has been expended during the past year in improvements.

Electrical Experts in Patent Cases.

Upon this important subject Mr. R. M. Hunter recently said:

"Electricity forms to-day the subject-matter of an enormous number of patents, many of which infringe upon each other to a greater or less degree. This infringement, though unfelt by large numbers at the present time, will not remain latent for ever, and in the course of a few years the bulk of patent litigation will unquestionably embody electrical devices of some kind. Even at the present day there are a large number of electric cases on the court dockets.

"In these patent cases it is the practice of the contestants or their lawyers to retain experts, whose duty it is to aid the side on which he is retained in pointing out to the court the essential features of the invention, as set forth, illustrated and claimed in the patent; show its advantages or defects, as the case may be, and interpret all matters purported to be anticipations of inventions. Much depends upon the expert, as in nearly all cases the court is not versed in the science of the matters under controversy, and the judges therefore rely upon the evidences of infringement deduced by the experts, and consider them in connection with the proofs of the defence.

"An expert in a patent case cannot be simply an electrician, no matter what his knowledge of the science may be, but must be equally good in reading and interpreting patents, and should have a good general knowledge of patent law as well. Until recently a mechanical expert was the demand, but it is gradually and surely changing to a call for electrical experts, and good electrical patent experts are scarce at the present time, though the future increased demand will also increase their number.

"To the general public a patent specification seems a simple, clear and comprehensive instrument, but to those initiated into the mysteries of patent law they invariably present great difficulties not readily overcome, being, in nine cases out of ten, badly drawn, and particularly badly claimed. It takes an expert to understand their true meaning and scope. It is his duty to compare the claims with the prior state of the art, considering them with all conceivable constructions and interpretations placed thereon, never losing sight of the fact that double use or mechanical skill are equally effective weapons in dealing with patents.

"The course of the prosecution or defence depends much upon the proofs of the expert, and in many instances entirely. It is, therefore, necessary, in acting in electrical cases, that he be not only familiar with the electrical science practically, but theoretically as well; for it is within his sphere to prove that the patent is inoperative or defective, or that alleged anticipating inventions will or will not work practically, as the case may be, by theoretical reasoning, and over practical tests and experiments.

"Electrical experts must also be versed in the mechanical arts and sciences, for in nearly all electrical contests these figure to a more or less extent, and hence an expert in a patent case involving the application of electricity must be educated, not only in mechanics, but in the electrical sciences as well, and requires, in most cases, a good general knowledge in theoretical and applied physics, and chemistry also.

"In summing up, then, an efficient patent expert in a case involving the application of electrical principles should be—1. Thoroughly capable of reading and interpreting patents. 2. Should have a general knowledge of patent law. 3. Should be thoroughly versed in theoretical and applied mechanics (especially mechanical principles and mechanism) and electricity. 4 Should have a good general knowledge of chemistry and physics. 5. Should have a knowledge of the state of the art. 6. Should be efficient in drawing. 7. Should be good at analysis of inventions, and preferably an inventor of quick perceptions.

"In addition to the reasoning power and sense of perception, it is also desirable that the expert be efficient in drawing, for it becomes necessary, in many cases, to illustrate answers in the testimony by sketches, which shall be both to the point and comprehensive. This will often explain to the court what could not be easily understood from words alone. This use of illustrations in answers also plays an important function in the analysis of inventions which it often becomes necessary to do, thus tearing away the outer cloak or disguise, and disclosing the same principles involved, but this practice of analysis is not generally understood or appreciated as yet as it will be in the future, and there are but few who are capable of accomplishing it, for it requires that the expert be an inventor of quick perception as well."

Notice.

The new (1884) edition, "Berly's Universal Electrical Directory," now ready for delivery, price $3, has been thoroughly revised, greatly enlarged, and many new features added to enhance its value. Send for descriptive circular and table of contents. Cumming & Brinkerhoff, 219 East Eighteenth Street, New York City.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 13, 1884.

298,341 Electric work-indicator for mills; Aaron D. Blodgett, Boston, Mass.

298,348 Element for storage batteries; Willard E. Case, Auburn, N. Y.

298,363 Individual electric-call apparatus; Albert P. Howes, Worcester, Mass.

298,397 Electric eye shade; Louis K. Oppenheimer, Cincinnati, O., assignor to Simon Lindeman, same place.

298,431 Inductorium; Charles J. Van Depoele, Chicago, Ill.

298,507 Electro-magnetic motor; Charles A. Saxe, Philadelphia, Pa.

298,531 Apparatus for lighting gas by electricity; Le Roy S. White, Waterbury, Conn., assignor to the Electric Appliance Company, same place.

298,543 Machine for turning insulator pins; Jos. J. Baldwin, Baltimore. Md.

298,550 Regulator for electric motors; Charles G. Burke, Richmond Hill, N. Y.

298,559 Telephone exchange apparatus; Thomas B. Doolittle, Bridgeport, Conn.

298,571 Quadruplex telegraph; George W. Gardanier, Saratoga Springs, N. Y.

298,593 Insulator; Joseph Slater Lewis, Birkenhead, county of Chester, England, assignor of one-half to William Phillips Thompson, Liverpool, England.

298,594 Terminal insulator; Joseph Slater Lewis, Birkenhead, county of Chester, assignor of one-half to William Phillips Thompson, Liverpool, England.

298,658 Socket for incandescent electric lamps; Sigmund Bergmann, New York, N. Y.

298,663 Process of and apparatus for extracting gold and silver from their ores; Charles P. Bonnett, Elizabeth, N. J.

298,676 Telephone transmitter; Daniel Drawbaugh, Eberly's Mill, Pa., assignor to the People's Telephone Company, of New York, N. Y.

298,677 Telephone transmitter; George W. Drawbaugh, Eberly's Mill, Pa., assignor to the People's Telephone Company, of New York.

298,679 Method of treating carbons for electric lights; Thomas A. Edison, Menlo Park, N. J assignor to the Edison Electric Light Company, New York, N. Y.

298,692 Skeleton arch for the support of electric wires; George M. Hoag, Evansville, Ind.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

Average Market Quotations of Battery Supplies for the Week Ending May 24th, 1884.

Leclanche Disque Cell, complete	$1.25
" Prism " "	$1.67
" Prisms, per pair	$1.00
" Carbon Mounted	30c.
" Jar Cover	12c
" Sal Ammoniac, in bag	8c.
" Porous Cell	$1.10
" Glass Jar	18c.
" Amalgamated Zinc	10c.
" Rubber Bands, per pair	6c.
Chlorine Battery, per cell	$1.25
Law Battery, per cell	$1.25
" Jar and its Rubber Ring	25c.
" Cover, with small Carbon sealed in	35c.
" Large Carbons, each	20c.
" Carbon Connector	12c.
" Zinc Connector	8c.
" Rubber Bolt	12c.
" Zinc and its Rubber Ring	12c.
Bergman & Haid, per cell	$1.20
Crow foot, 6x8, per cell	75c.
Callaud Zincs	30c.
" Coppers	15c.
" Jars	25c.
Sal Ammoniac, per lb	15c.
Blue vitriol, per lb	10c.
" " bbl., lots, per lb	5½c.
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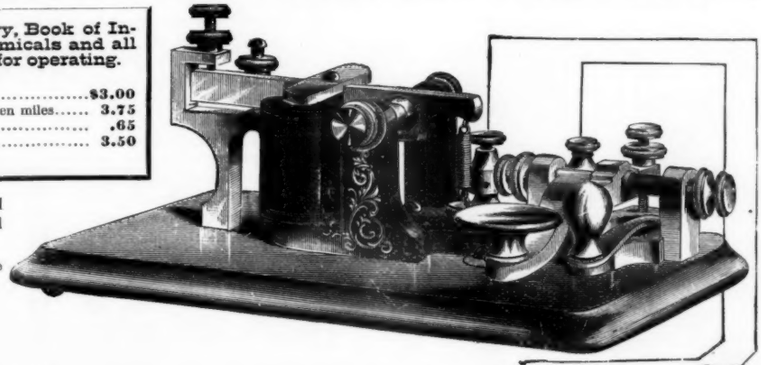

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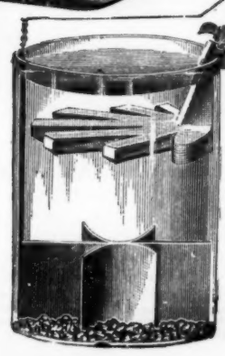

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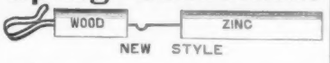

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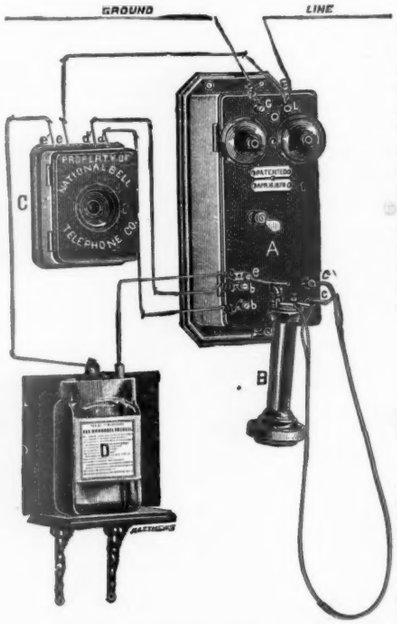

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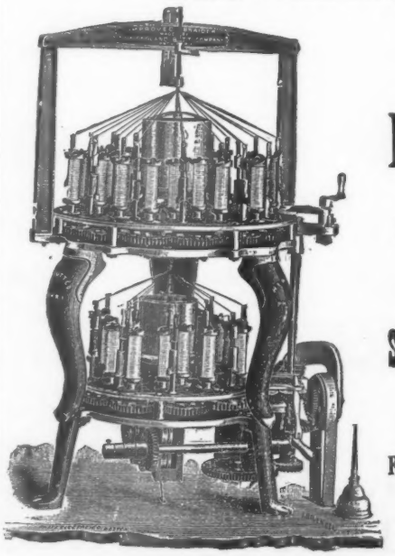

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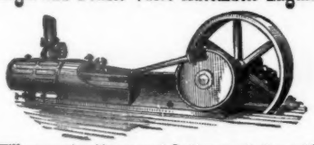

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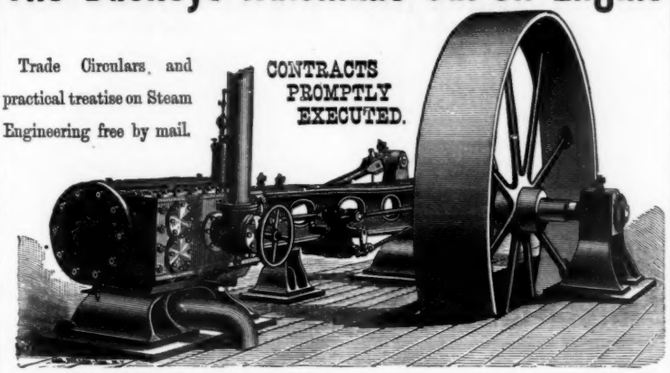

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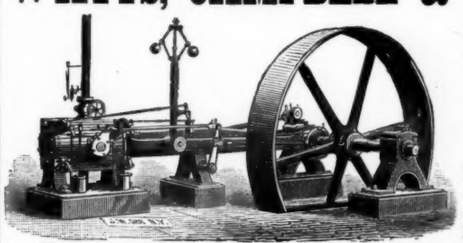

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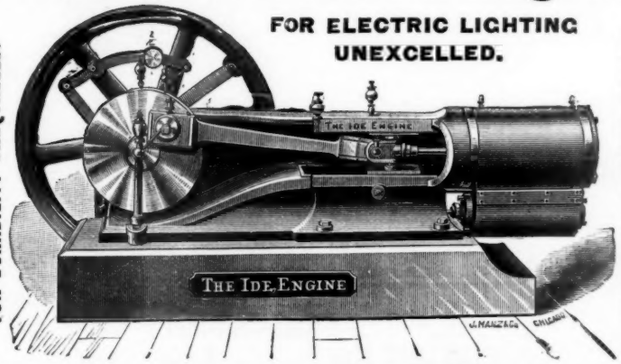

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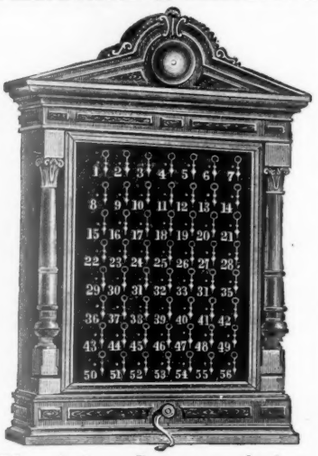

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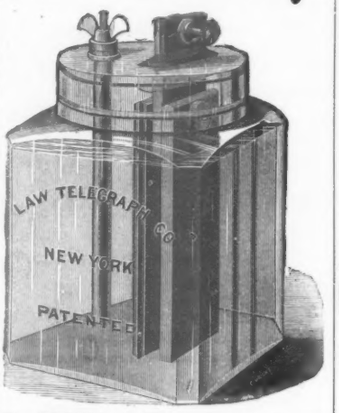

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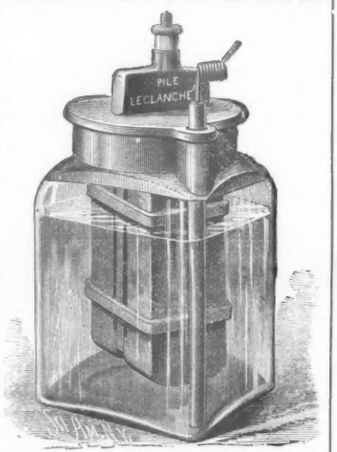

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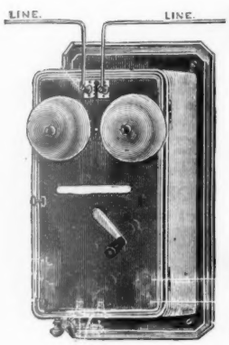

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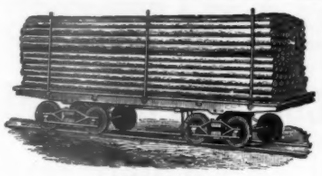

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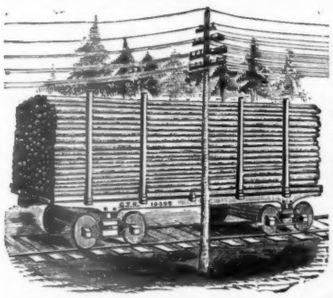

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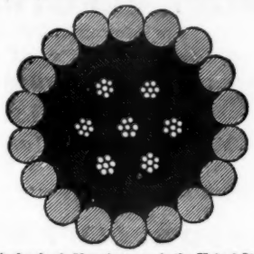

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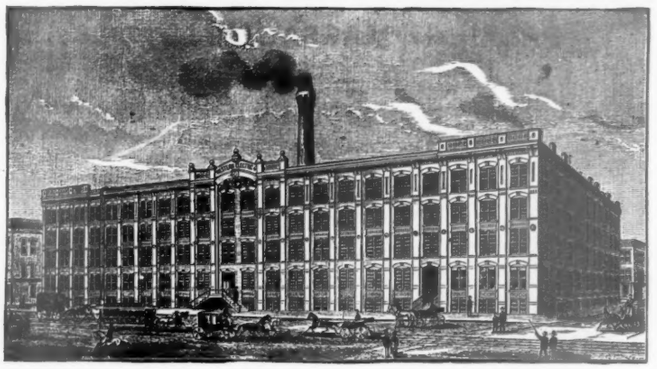

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